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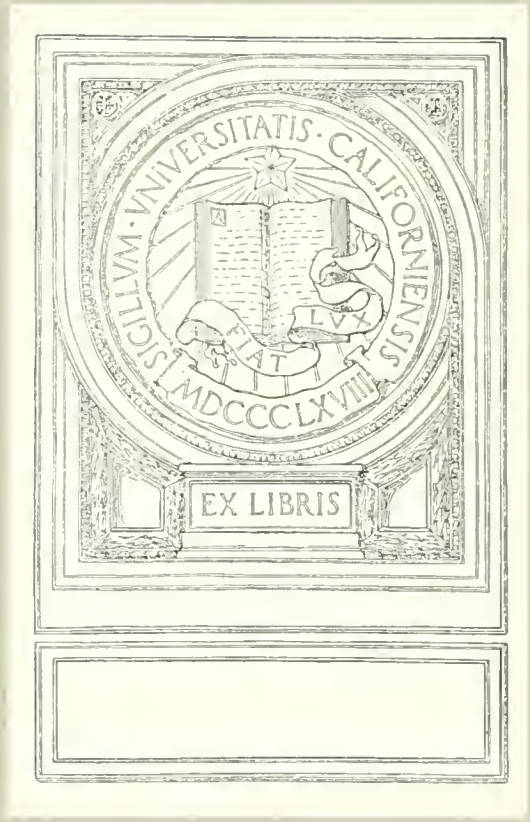
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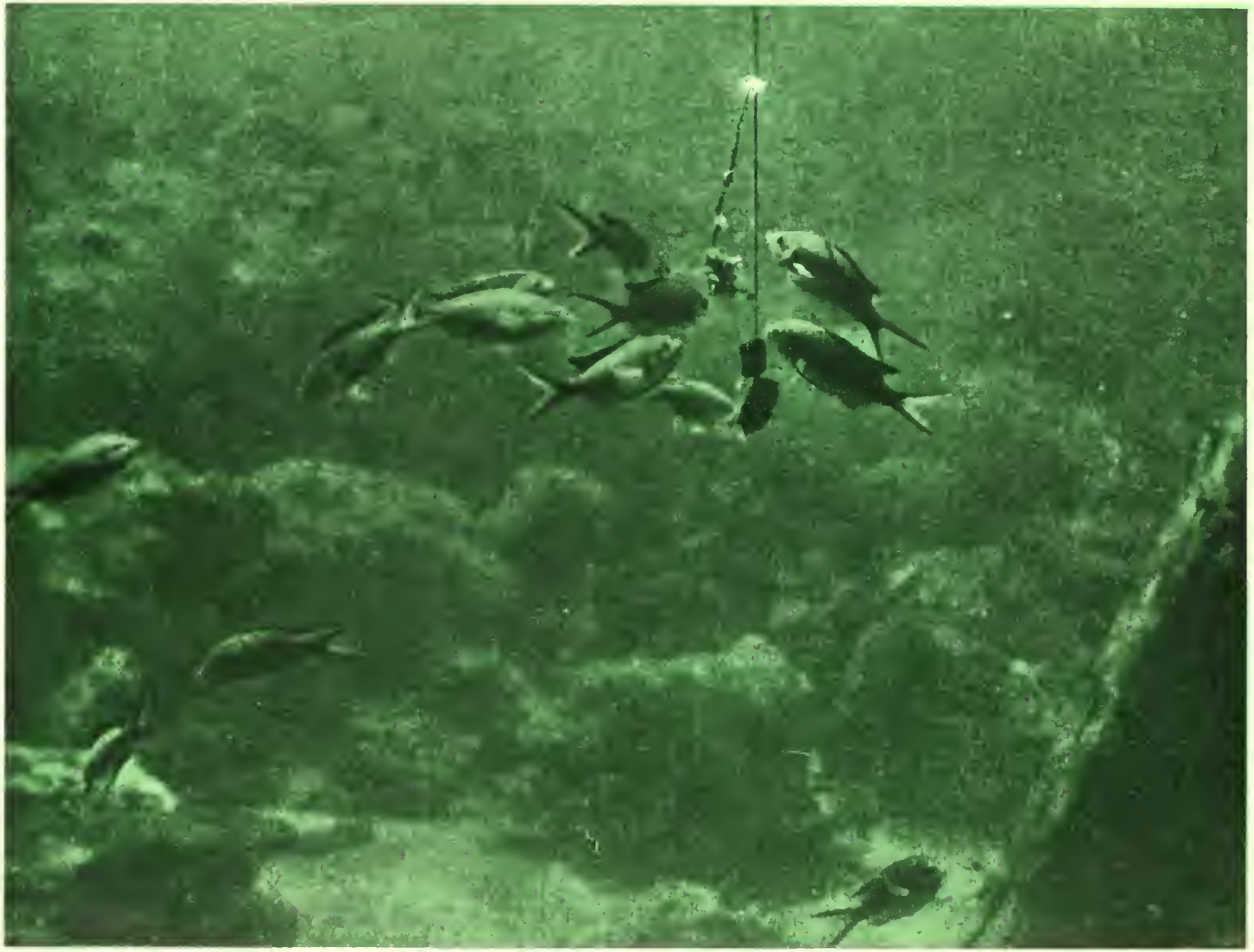

SMALL FISH TAKING BAIT FROM A LINE OVER THE OCEAN BED. *Frontispiece.*

WONDERS OF THE DEEP

The Story of the Williamson Submarine Expedition

By VICTOR E. ALLEMANDY

Author of "The Normal Reign of George III." "The Growth of the British Dominions," etc.

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CALIFORNIA

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CONTENTS.

CHAP.		PAGE
	Introduction	7
I.	The Birth of an Idea	13
II.	In the Bahamas	23
III.	At Nassau	34
IV.	Getting Ready	40
V.	Taking Submarine Motion Pictures	45
VI.	Denizens of the Deep	49
VII.	Some Oddities of Fish Life	57
VIII.	Sponge Fishing	63
IX.	The Coral Architect	72
X.	Deep-Sea Diving	79
XI.	A Thrilling Fight with a Blue Shark	87

INTRODUCTION.

More than one hundred and fifty years ago Thomas Gray, in his famous "Elegy Written in a Country Churchyard," penned these lines:

> "Full many a gem of purest rays serene,
> The dark, unfathomed caves of ocean bear."

Until the middle of the nineteenth century very little was known of the immense ocean depths. Speculation and imagination had been rife with regard to the life and conditions below the surface of the ocean, but little definite knowledge had as yet been gleaned.

Towards the close of the year 1872, H.M.S. "Challenger" sailed from Portsmouth on a voyage round the world, which lasted for three and a half years. The main object of this cruise was to investigate the physical conditions and natural history of the deep sea in various parts of the world. The ship was equipped with special apparatus for sounding and dredging purposes, for obtaining specimens of sea-water and its

inhabitants at various depths, for testing the temperature of the ocean, and for preserving specimens for subsequent observation and examination. This expedition accumulated a vast quantity of facts, statistics, and specimens, and its scientific results proved to be of incalculable value. A great many sciences were enriched by this accumulation of new facts. The success of the expedition was altogether beyond the expectations of its promoters. In fact, as an outcome of this cruise a new science, which we call "oceanography," had its birth.

Glimpses were now obtained of the fascinating world below the level of the ocean, the countless and diverse forms exhibited by animal life and plant life; the numerous battles fought with the greatest courage and desperation between the different inhabitants of the ocean, sometimes between members of the same species; the beauties of the flora or plant world; the innumerable low forms of life, invisible to the naked eye; the nature and composition of the floor of the ocean, and many other things. We began to learn something of the deep and almost unfathomable secrets of the mighty and mysterious ocean.

The trawlings and dredgings carried out by the "Challenger" disclosed the fact that animal life exists at all depths, and that the ocean bed itself consists of different kinds of mud, or slime, called ooze, which is in some places blue, in others red, and in others green. Much of this ooze, it was

afterwards discovered, is composed of the remains of minute forms of animal life known as animalculæ. It also contains shells and the teeth and bones of larger animals. The "Challenger" expedition discovered, too, by a long series of soundings, that the deepest part of the ocean, away in the far Pacific, was 4,500 fathoms, or 27,000 feet. More recent soundings, however, have given the deepest part of the Pacific Ocean as over 32,000 feet, or slightly more than six miles. Can we realise what this really means? If we could take Mount Everest, in India, the highest mountain peak in the world, and place it in the deepest part of the Pacific Ocean, the peak would be three thousand feet below the level of the ocean.

Another important fact ascertained by the "Challenger" expedition was that the bed of the ocean is uneven, like the surface of the land; there are peaks and valleys under the ocean similar to those with which we are familiar. The enormous collections that were brought home by the expedition were subsequently studied and described by well-known specialists belonging to nearly every civilised nation. Some idea of the importance and value of the expedition may be gathered from the fact that the official records and descriptions fill fifty bulky volumes.

No sunlight whatever penetrates the deepest parts of the ocean. Probably all is dark below two hundred fathoms, *i.e.*, twelve hundred feet, except the small degree of light emitted by the

phosphorescent animals. Owing to the lack of sunlight, there is an almost entire absence of vegetable life in the deepest parts of the ocean. Sir John Murray, the eminent oceanographer, calculates that on more than nine-tenths of the ocean floor there are no forms of vegetation of any kind.

Our knowledge of the ocean and the ocean depths is still far from complete. So many difficulties exist that progress must necessarily be slow. These difficulties arise principally from the fact that, in the majority of cases, the observations are necessarily indirect. At the surface of the ocean direct observation is possible, but our knowledge of the conditions prevailing in deep water, and of all that is there taking place, is almost wholly dependent on the correct working of instruments, the action of which at the critical moment is hidden from sight. Dredgings and soundings, however, reveal many important details, and divers are able, from time to time, to add to our knowledge of marine life and conditions.

When the cinematograph first made its appearance no one dreamt of its enormous and far-reaching possibilities as a scientific instrument. Essentially, at the outset, intended to provide a cheap form of amusement, it was not long before it was seen that the cinematograph could be used not merely for purposes of entertainment, but also for those of instruction. At the present time we are beginning to understand a little more

about the future possibilities of the cinematograph in connection with science and education.

The remarkable and unique application of the cinematograph to obtaining details of submarine life, the story of which will be told in these pages, reflects the greatest credit on the perseverance and ability of the Williamson brothers, who succeeded in perfecting the apparatus for taking submarine motion pictures—truly a wonderful achievement. The illustrations reproduced in this book are taken from photographs filmed by the Williamson Submarine Expedition. They enable us to understand the apparatus employed, and bring before us the panorama of a marvellous submarine journey of thirty leagues along the floor of the ocean. We shall read about the famous Marine Gardens which form one of the great attractions of Nassau, in the Bahamas, and can picture in imagination the indescribable beauties of the deep. Nature's wonders, whether in plant life or in animal life, in their myriad forms are placed before us. Scenes connected with sponge fishing and coral fishing have been photographed; we witness a diving scene; and, probably the most wonderful of all, we get a pictorial representation of a desperate life-and-death struggle between a daring swimmer, armed only with a knife, and a huge, blue, man-eating shark, the terror of the Bahama waters. This is undoubtedly one of the most thrilling scenes ever beheld by human eyes.

For the first time in the history of mankind some of the secrets of the ocean have been revealed, and the story of the methods by which this has been done forms the subject-matter of this book.

CHAPTER I.

THE BIRTH OF AN IDEA.

It is always a matter of no little interest to trace the development of an idea in an inventor's mind from its inception to its conclusion. Many valuable ideas have their birth, but, unfortunately, for one reason or another, they die a premature death. The idea is probably found to be impracticable, or it may prove to have no commercial value; and sometimes lack of knowledge or finance prevents an inventor from carrying his idea out to a practical and satisfactory conclusion.

Many of our greatest and most marvellous inventions and discoveries have originated from simple beginnings. James Watt, for example, was led, from merely watching the movement of the lid of a kettle of boiling water, to develop certain ideas with regard to the application of steam power to driving a stationary engine. Isaac Newton, one of our most eminent scientists, one day saw an apple drop from the tree to the ground—an occurrence that had been witnessed by thousands and thousands, but no one ever seems

to have asked himself the question: "Why does the apple fall to the ground?" This simple incident set Newton's mind to work, and after many years' thought and study resulted in the discovery of the law of gravitation.

Sir James Simpson's discovery of the anæsthetic properties of chloroform, which produces an insensibility to pain, was the result of an accident. For some years the young physician had been conducting experiments in this direction with different drugs, and had obtained various results, none of which so far had proved satisfactory. One night he resolved to carry out an experiment with chloroform. He and his two assistants, sitting round the supper-table in the dining-room, inhaled some of the fumes. Their conversation immediately became brighter; then, after a short while, came a silence, succeeded by the sound of falling bodies. By and by Dr. Simpson awoke. Anxiously looking about him, he heard one of his coadjutors snoring hard, and saw the other just struggling from the floor to his chair. From the curious sensations they had experienced, the doctors realised that they had at last discovered a valuable anæsthetic, one that was destined to confer an immeasurable boon on hundreds of thousands of persons.

Hundreds of similar instances might be adduced to show that wonderful inventions and discoveries have often sprung from ordinary incidents, occasionally from accidents, or have been

THE WILLIAMSON BROTHERS, WHO ORIGINATED THE IDEA OF SUBMARINE MOTION PICTURES

MR. WILLIAMSON IN DIVING DRESS PREPARING TO MAKE A DEEP SEA DIVE

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the outcome of close observation and intense study.

What was the origin of the remarkable idea which was carried to such a successful issue, that it became possible for the first time in the history of invention and discovery to take motion pictures below the surface of the ocean?

About the time that Commander Robert E. Peary was engaged in an endeavour to reach the North Pole, and Captain Robert F. Scott was seeking to wrest from Nature some of the hidden secrets of the South Polar regions, two young men, hardly out of their teens, were labouring in the back-yard of their home in Norfolk, Virginia, over a peculiar invention, with the aid of which they hoped to explore the bottom of the ocean, and thus add to our knowledge of submarine life at those depths. Their names were Ernest and George Williamson, the brave and fearless sons of Captain Charles Williamson, one of the smartest skippers that ever sailed before the mast, and to whom, as we shall see, they really owed their success.

Captain Charles Williamson possessed an inventive faculty, and he was never happier than when endeavouring to work out certain suggestions and ideas that presented themselves to his mind from time to time. Several of his inventions proved very successful, not only in themselves, but also from a financial standpoint. During one of his trips he invented a folding

baby-carriage, which is now used by many thousands of children all over the world, and from which he continues to draw a royalty. On another occasion he constructed a rotating lamp shade, operated by the heat of the lamp acting upon a little turbine over the chimney, and designed to show pleasing transparencies. He also evolved an amusing and instructive aerial golf game, which is played on a red-and-white sheet stretched beneath the ceiling, the balls being small balloons driven into pockets in the sheet by means of cork-tipped sticks. But perhaps one of his most useful inventions was his system of code signalling between vessels at sea, by the use of certain recognised coloured lights.

A few years ago the ship that was being navigated by Captain Charles Williamson encountered, off Cape Hatteras, an exceptionally heavy gale, which had the effect of straining the side seams of the vessel near the water-line. With every roll of the vessel the water rushed like a torrent through the gaps that had been made, and Captain Williamson was not slow to see that if his ship was to be saved the seams must be closed, and that without any further delay. Here, fortunately, his inventive genius came to his aid. He had himself lowered over the side of the ship in a long canvas bag fitted with legs, like a breeches buoy, and sleeves, and provided with a glass window to enable him to look through.

Nothing like this had ever been used before,

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but it answered very well for the purpose in hand. The canvas tube protected the occupant from the furious waves which dashed against the vessel, and the sleeves secured freedom for his arms, and enabled him to carry out the caulking of the seams, and thus save his vessel from otherwise certain disaster.

It seems truly remarkable that the simple and unique contrivance which had been utilised for caulking the gaping sides of the storm-tossed vessel should have suggested a method of developing that invention still further, and should have led ultimately to the adoption of the principle for the exploration of the bottom of the ocean. From this crude and temporary canvas bag, then, was evolved the Williamson deep-sea tube that has made possible an exhaustive examination of submarine life, and the production of a remarkable film that is not only instructive and interesting to the general public, but that has also proved of the greatest value to the biologist and the zoologist.

The Williamson deep-sea tube, of which a more detailed description will be given later, possesses three essential characteristics: namely, it is sufficiently large to enable a man to pass up or down inside it; it is strong enough to resist the pressure of the water at a considerable depth; and it has the merit of being thoroughly pliable and flexible.

As it hangs beneath a supporting vessel, the present Williamson model reminds the onlooker of

an enlarged Chinese lantern. It has a length of from fifty to sixty feet, and is three feet in diameter. It sways and bends easily with the tide or with the movements of the vessel above, and its concentric iron rings stretch apart, or flatten together, in the manner of a concertina or an accordion. Without this flexibility, of course, the invention would have been of no practical value, for a long, rigid, and very heavy tube, dragged through the sea by the vessel to which it was attached, would inevitably have been torn away from the vessel by the immense leverage of the opposing mass of water.

Before explaining any further the construction and operation of this deep-sea tube, it must be mentioned that Captain Williamson had no thought whatever, when he made his invention, of its being ever utilised for the purpose of obtaining submarine motion pictures. His sole object was to provide a means of descending into the sea to obtain sponges, pearls, coral, sunken treasure, and anything else that might be of commercial value or of historic interest. As a matter of fact, the Captain saw so many possible applications of his tube, each of which required separate patent protection, that several years passed by after the first model had been successfully tried before any practical results were obtained.

"Like father, like son" is a phrase we are accustomed to hear frequently, and in this particular instance heredity also endowed the sons

with an inventive faculty, and they took up the work where their father left off, and were thus enabled to give the present generation a means of probing the wonders of the depths of the ocean.

One memorable summer evening, in the year 1912, Ernest Williamson, the Captain's eldest son, who was then engaged as a cartoonist and photographer on the "Virginia Pilot," happened to be in a town in Yucatan. Just as the sun was setting he was passing a tall apartment house, and the steep side of the building, seen in a golden haze, with long, slanting shadows over it, looked like a mysterious fortress under the sea. This uncommon sight immediately recalled some motion pictures he had seen of fish taken in an aquarium tank. Then, all of a sudden, an inspiration flashed through his mind. Why not utilise his father's tube as a means of taking photographs under the water?

No sooner had the possibility of the thing occurred to him than he straightway placed the proposal before the Captain, who, strange to relate, seemed to take but little interest in the suggestion, not, perhaps, at the moment realising the full significance of the idea. At any rate, he raised no objection to the proposed plan, and eventually came to the conclusion that the idea might after all be practicable. Having obtained the Captain's permission, Ernest was not long in securing the co-operation of his brother George, and the two, fired with youthful enthusiasm, and realising the

enormous and valuable possibilities should the invention prove to be practicable, proceeded with ready industry to work out a new and unique method of taking submarine pictures. We must not lose sight of the fact, as the story proceeds, that nothing of the kind had ever been attempted before, and that in their endeavours the brothers were pioneers, with no previous experience or guidance on which to work. The idea was thus quite a novel one, and, if it could be turned into a concrete form, would become a unique invention.

With as little delay as possible, the Williamson tube was rigged up and lowered from the barge "Ada" to a depth of about thirty feet, but the waters in Norfolk Harbour were so dark that it was altogether impossible, in ordinary daylight, to see through them for more than a distance of a few feet. This presented the first problem that the pioneers had to solve. Undaunted, however, by this initial set-back, the young men decided to employ artificial light, and after some considerable difficulty, they succeeded in arranging a large battery of tungsten electric lamps in such a way that they would continue to shine after they had been lowered into the sea.

Having accomplished this, Ernest Williamson climbed down through the tube into the observation chamber and took up his position, with a camera ready, behind the heavy glass window. A baited line was lowered, the electric lights were turned on, and in a moment the photographer

was busily engaged in snapping photographs of fish that swarmed in thousands about the apparatus.

The idea of adapting the invention to the purpose of taking motion pictures below the ocean had not yet occurred to them, but a number of exceptionally interesting submarine snapshots were obtained, and the success that had attended their first efforts convinced them of the great possibilities of taking pictures in deep water, many fathoms below the surface of the sea—something that had never been done before.

With an exposure of one-fiftieth of a second or less, they found it possible to take perfectly distinct pictures of various small fish—spot fish, croakers, and other species; and when George Williamson dived down to a depth of thirty feet and posed before the observation window, holding in his hands a copy of a magazine, the underwater picture was almost as good as if it had been taken in the ordinary way in the daylight.

This achievement was accomplished in the summer of 1912, and in the autumn of the same year the Williamson brothers exhibited their submarine photographs in New York City at the first International Motion Pictures Exposition, where, as we should naturally expect, they caused no little sensation, and attracted the attention and aroused the interest of scientists from all parts of the world. The possibilities of further development occurred to several prominent business men, and before long the two brothers found that they

could secure financial support from a group of solid business men, mostly Southerners, who organised a company to develop a submarine moving picture enterprise, and made arrangements for the despatch of an expedition to some suitable spot, afterwards to be selected, where they were confident that the Williamsons would succeed in attaining their object. The results subsequently achieved showed, beyond the shadow of a doubt, that the confidence placed by this small group of business men in the two enthusiastic inventors was not misplaced, for the expedition turned out to be an unbounded success from every standpoint.

CHAPTER II.

IN THE BAHAMAS.

A CONSIDERABLE time elapsed before the Williamson Submarine Expedition was fully equipped for its work and ready to set out for its destination. Many preparations had to be made; numerous details had to be worked out; the necessary photographic apparatus and special lenses had to be purchased; the members who were to comprise the party had to be selected; and it was essential to decide upon a suitable locality for the operations of the expedition.

Obviously, the selection of a convenient and desirable spot was a matter requiring very careful consideration, because a number of important factors had to be taken into account. After considerable deliberation, the party decided to proceed to the Bahama Islands. Several reasons led to the choice of this locality. One was the suitability of the climate, for this would permit of the conducting of a series of uninterrupted operations. Another reason was the beautiful crystal clearness of the waters in this region. A third deciding factor, and one which weighed greatly with the

members of the expedition, was the unrivalled beauty of the coral formations, the remarkable diversity and beauty of the submarine plant life, and the large number of interesting forms of fish life with which these waters abound. Then it was also necessary to determine the best time of the year to set out. As the wet season begins in May and lasts until December, this fact had likewise to be taken advantage of.

The members of the Williamson Submarine Expedition comprised the Williamson brothers, Keville Glennan, the historian of the expedition, and Carl Gregory, an experienced cinematograph operator.

Late one afternoon, on a windy day in March, 1914, the Williamson Submarine Expedition sailed out from New York harbour, bound for Nassau, the capital of the Bahama Islands. As the party left the harbour they obtained a magnificent view of the splendid bronze Statue of Liberty erected on Bedloes Island. This statue, which is reputed to be the largest in the world, is the work of Bartholdi, a famous French sculptor, and was presented to the United States of America by the people of France—a gift from one republic to another. Measuring over one hundred and fifty feet from the base to the top, and standing on a huge pedestal, the statue is designed in the form of a female figure personifying "Liberty Enlightening the World," and holding a torch, which is lighted at night-time by electricity.

A pleasant voyage of four days brought the expedition to the surf-beaten coral coast of the Bahamas, which form a group of the West Indies. The steamer was obliged to anchor some distance outside the harbour of Nassau, as it is impossible for steamers of any size to enter the harbour owing to the presence of an immense sandbank at its entrance. Passengers and freight have therefore to be transported to the dock by means of a tender.

A few facts about this charming group of islands will not be out of place here.

The Bahamas, appropriately described as the "Land of the Pink Pearl," lie to the west of the United States, and extend from Florida, in a south-easterly direction, for about four hundred miles to the island of Hayti. They form an archipelago of twenty-nine islands, six hundred and sixty "cays," or islets, and over two thousand rocks. The area exceeds four thousand four hundred square miles, equivalent in size to about one-seventh the area of Scotland. The chief island is New Providence, on which stands the capital.

The majority of the islands forming this archipelago are of coral formation, and this, as has already been stated, formed one of the reasons for the selection of the Bahamas by this expedition. The coral reefs, to be described later, are covered with a kind of sandy loam. Some of the islands, however, are of volcanic origin, and the soil on those islands needs only heat and moisture to make it produce enormous crops.

Mr. William Drysdale, formerly of the 'New York Times,' gives, in an admirable book, the following description of the soil of New Providence and its fertile properties:—

'The whole island is a mass of stone of the coral limestone order. But this rock is soft, and trees and plants grow in it as well as in the earth. There is hardly a bare spot on the whole island, except where it has been cleared. In some places are large tracts of pine woods; in others, the ground is hidden by dense masses of a sort of chapparal, growing ten to twelve feet high, and nobody would suspect the foundation. There is a foot or two of soil in some places that has come from nobody knows where. But the usual process of making a garden is to break an acre or so of the rock with a sledge or crowbar, mash it up fine, and mix in enough earth to prevent the rock from hardening again. In this compound anything under the sun will grow, and grow abundantly.

'A man who takes this much trouble to make a garden can have green peas and fresh lettuce and all the other vegetables every day in the year. There is no season when vegetation does not flourish, and when the garden is once made, it is always there. Men go out with crowbars and set cocoa-nut trees, and in a few years they are tall and beautiful, and bear a cocoa-nut (as the saying goes) for every day in the year. There is nourishment for plants in the material of the rock.

'Where this coral limestone rock came from is

a question that scientific people can settle for themselves. It makes no difference where it came from; it is here, and is very useful. Nearly all the houses are built of it. You have only to saw down into the quarries to get beautiful big blocks of it that make handsome and substantial houses. The blocks harden by exposure to the air, and in this climate soon become as durable as granite. Out of the rock, too, water-tanks are built to catch rain-water."*

The innumerable reefs, with their warm lagoons, are the site of important turtle and pearl fisheries, as well as the sponge fishery, and of the salt and ambergris industries. In the larger islands are produced immense quantities of fruit of all kinds, especially pine-apples, grape-fruit, oranges, pomegranates, and bananas. Other important productions include the sugar-cane, tobacco, ginger, coffee, and indigo. As a matter of fact, there is hardly a tropical fruit or product that will not grow in this archipelago, and most of the European vegetables can be cultivated without difficulty.

Plant life, in its myriad forms, is most luxuriant. The mango is a fruit rarely seen out of the tropics, but to a white person the taste is certainly an acquired one, for certain specimens of this fruit taste very strongly of turpentine. Then there is the luscious and juicy sapodilla, a kind of pear. If the fruit falls prematurely from the tree the natives

* "In Sunny Lands." By William Drysdale. Harper Brothers, New York.

put it in their beds to ripen, after which it is on sale in the open market. The Bahama cherry reminds one of the English fruit because of its ruby colour, but its flavour resembles that of the raspberry. There are many other kinds of fruit growing in the Bahamas, fruits with strange names, novel forms and sickly flavours. Although most of them are very palatable to the Bahama natives, they seldom find much favour with European and American visitors.

One of the remarkable phenomena that arrests the attention of visitors is the "banana holes" which frequently occur in the limestone. The formation of these holes, which are curiously regular in shape, has been attributed to the effect of rotting vegetation on the rock. Some of these "banana holes" have a depth of forty feet.

The island scenery is most picturesque, gaining beauty from the fine colouring of the sea and the rich luxuriant vegetation. The waters swarm with fish of every kind. Ornithologists and bird-lovers are charmed with the variety of bird life to be found in these islands. Here are to be seen wary flamingoes, beautiful humming birds, wild geese and ducks, hawks, and green parrots. Tradition declares that once upon a time the islands boasted of a breed of dogs that never barked.

The finding of pearls is probably one of the most interesting industries in the world. It is carried on with every element of romance and by methods which have not materially varied during

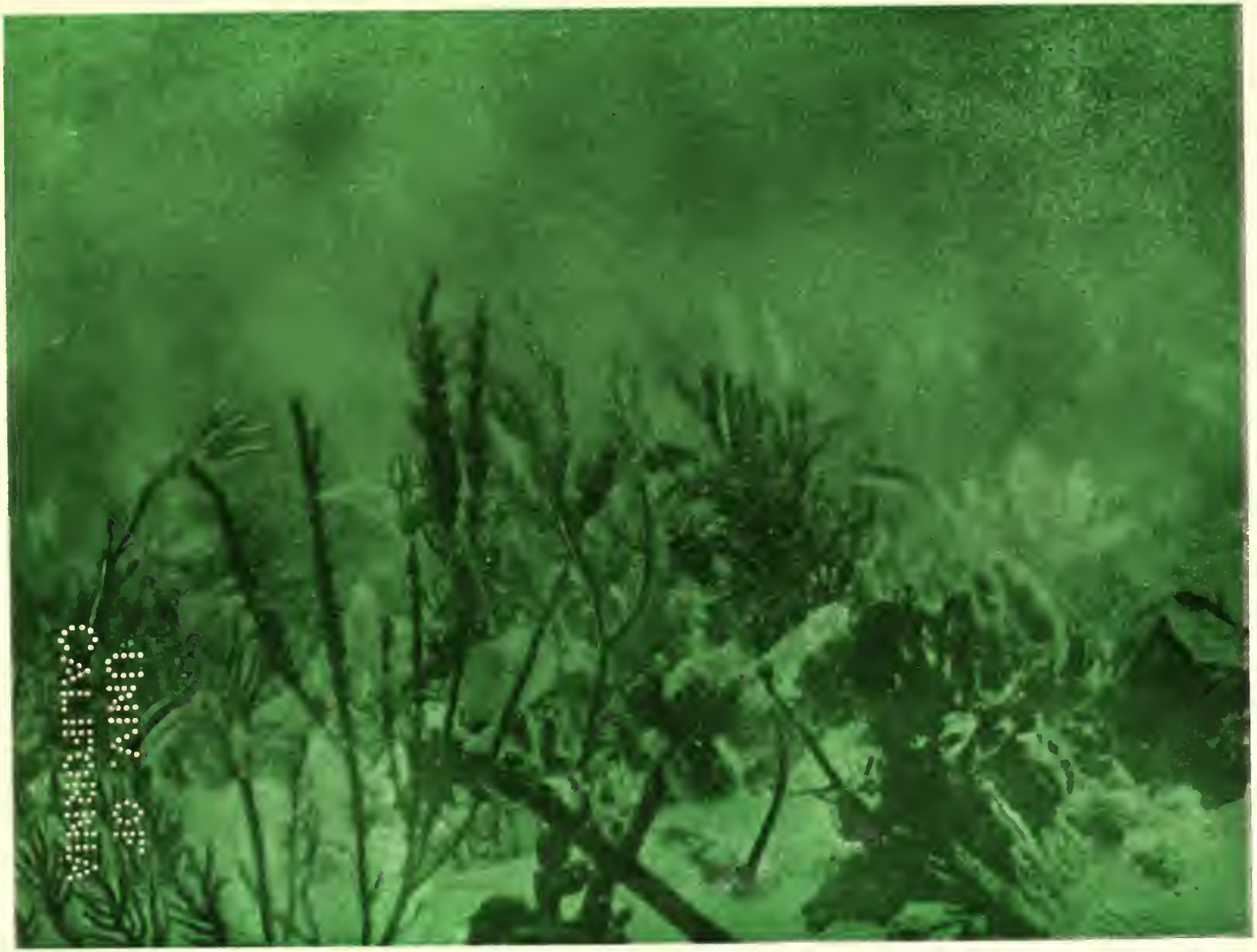
historic times. It is an industry that can only be prosecuted for a short season in the year. The profits are a gamble; while the beautiful products, useless in themselves, are only valuable owing to the pride and vanity of the purchasers. Pearls, one of the valuable products of the Bahamas, fetch a good price, some being worth as much as eight pounds sterling a grain. Many of the pearls are found accidentally. A case is recorded of a man having bought a conch, or large shell-fish, for his morning's repast, for which he paid the equivalent of a halfpenny, and on going home found embedded in the shell a magnificent pearl, which, when sold, fetched sixty pounds.

The following story of an actual incident has been related: In a settlement on one of the Bahama islands, a native woman one day was busily engaged in opening some conch shells and removing their contents. While she was thus occupied, a wild duck seized a shell-fish in its beak and rapidly made off with it. The woman, anxious to recover the conch, thereupon chased the duck. A child, who happened to be standing by, saw a pearl drop from the conch which the duck was carrying, but the woman, being so intent on the chase, did not notice the pearl fall to the ground. The child naturally picked the pearl up and took it home to her mother. Guessing that the pearl might be a valuable one, the woman took it to Nassau, where she sold it for forty pounds. Some while afterwards the news of this

discovery reached the ears of the original owner, who claimed that the money received for the pearl really belonged to her. But the woman who had effected the sale disputed the claim. Matters now became rather serious, and the original owner threatened to take the matter into Court. Discretion proving the better part of valour in this case, the vendor agreed to pay the other woman a third of the money for which the pearl had been sold. It afterwards transpired that the pearl in question was an exceedingly fine one, and was worth about two hundred pounds.

Much of the history of these delightful islands is "wropped in mystery." Red Leiric, a daring navigator, is said to have visited the islands nine hundred years ago, and spent twelve months there with his storm-driven crew. Five hundred years before that, so the legend runs, St. Brendan, an Irish missionary, endeavoured to spread the principles of Christianity in this region. But these, and other traditional accounts, must be regarded, delightful though many of them are, as belonging to the realms of myth and legend. It is not until we come down to the fifteenth century that we can feel we are on safe historic ground.

Although the Bahamas were the first part of the New World to be discovered by Christopher Columbus, the Genoese navigator, during his momentous voyage towards the close of the fifteenth century, in quest of a westward route to India, the Spaniards, in whose name the islands



DEEP-SEA FLORA.

SEA FERNS BENDING IN THE DIRECTION OF THE OCEAN CURRENTS.

PLACING IN POSITION THE HUGE CIRCULAR GLASS PLATE WHICH FORMED THE WINDOW OF THE OPERATING CHAMBER.

A GLIMPSE OF LIFE AT THE BOTTOM OF THE OCEAN.

A DENIZEN OF THE DEEP.

AN EXAMPLE OF THE WONDERFUL VARIETY OF FORMS AT THE BOTTOM OF THE OCEAN.

NATIVE DIVER TYING AN ANCHOR ROPE AT THE BOTTOM OF THE OCEAN.

were claimed by the discoverer, made no attempt to occupy them permanently, but carried away almost the whole of the native population to San Domingo to work in the mines or dive for pearls, and for more than a hundred years these islands became verdant deserts. As many as forty thousand natives are said to have been deported. It was not until the seventeenth century that the Bahamas were frequented by vessels from the Bermudas, situated about six hundred miles from the eastern coast of the United States, which came to obtain large quantities of salt. During the seventeenth century a Captain Sayle was wrecked on one of the islands, and the favourable account that he gave of them caused the proprietors of Carolina to petition King Charles II. of England to grant them possession of the islands. Captain Sayle had named the island on which he was shipwrecked "New Providence," and it is on this island that the capital, Nassau, is situated.

The Bahamas have passed through many vicissitudes, having been plundered at various times, first by the French and then by the Spaniards, who, at each plundering expedition, carried off a number of the negroes. Early in the eighteenth century the island of New Providence became a favourite and notorious rendezvous for pirates. Some ten years later, as an outcome of an appeal of the merchants of London and Bristol to the Crown, to take stringent and effective measures to restore order in the island and root out the

pirates, Captain Woodes Rogers was sent to the island with a force sufficiently strong to destroy the nest of pirates infesting the shores, a service which was promptly effected by that old buccaneer. During the War of American Independence (1776-1783) the islands frequently changed hands.

The abolition of slavery in the West Indies and in all other tropical possessions within the British Empire, in the year 1807, which was the outcome of the political agitation organised by William Wilberforce, Thomas Clarkson, and other social reformers against slavery in any of the countries under the British Crown, caused many of the extensive cotton and sugar-cane plantations to be abandoned because many of the natives, now that they were free, refused to work at all, preferring to devote themselves to the cultivation of small patches of maize, yams, and other tropical produce.

Blockade-runners made good use of Nassau during the American Civil War of 1861-1865. This occurred as the result of the closing of the southern ports of America by the Federals. While the blockade-running lasted, the island enjoyed an unexampled prosperity, the value of the trade having risen from about a quarter of a million to nearly five and a half millions.

When Columbus passed through the islands he was struck with admiration at the character and fine bearing of the natives, and in one of his letters to King Ferdinand of Spain and Queen

Isabella, the patrons of his expedition, he wrote: "This country excels all others as far as the day surpasses the night in splendour; the natives love their neighbours as themselves; their conversation is the sweetest imaginable; their faces are always smiling; and so gentle are they and affectionate that I swear to Your Highness there is not a better people in the world."

For a long time there was a dispute regarding the exact landing-place of Columbus and his gallant crew, on the occasion of his remarkable discovery of the New World. Various spots were declared to have been the actual landing-place of the intrepid navigator. Careful historical research and close examination of the different spots eventually showed that Watling Island, called by the natives "Guanahani," but named by the explorer "San Salvador," was the place where Columbus first set foot, after his momentous and daring voyage across the Atlantic Ocean, on October 12th, 1492, and planted there the banner of His Most Catholic Majesty of Spain. On this spot has been erected a crude monument in commemoration of that memorable event. As one gazes at the lonely wooded beach, one can almost mentally picture the inquisitive and startled Indians emerging from behind the trees, and, with hesitating steps, gradually make their way down to the beach to welcome the white strangers as they waded ashore from their small boats, as soon as they intuitively felt sure that they were not hostile visitors.

CHAPTER III.

AT NASSAU.

From the sea the view of Nassau, the capital of the Bahamas and the seat of the Government, is very striking, especially to anyone who is not familiar with tropical scenery and grandeur. At the entrance to the harbour stands a lighthouse; this is rendered necessary as a safeguard to shipping, owing to the presence of the immense sandbank previously referred to. About five hundred feet from the harbour runs a slope which reaches a height of ninety feet, and along which the town of Nassau has been constructed. Flowers of every description and colour abound with tropical profusion, and it is the presence of these, together with the beautiful tints of the sky and the water, that make the place appear to be a veritable garden of enchantment.

As soon as a vessel nears the harbour a group of native boys collect on the shore by the side of the dock. The visitors encourage them to do this by throwing coins down into the water for them to pick up. When the coin has been located, the native boy places it in his mouth, which, in his

case, is the only place of safety. Some of the youngsters are clever enough to catch the coin as it sinks through the water. Most of the natives, as will have been gathered, are as much at home in the water as they are on the land. A few of the more daring of these young divers can stay below the surface of the water for a space of three minutes! In time, however, this practice tells upon their health, for the constant retention in the lungs of air mixed with water gives rise, when they grow older, to serious bronchial trouble.

Probably the greatest attraction of Nassau is the beautiful Marine Gardens, exhibiting an extraordinarily wonderful development of marine organisms. The colours of the flora and the fauna are absolutely beyond description, and the kaleidoscopic masses of vivid purples, blues, reds, greens, and yellows are simply bewildering.

One who was for several years a resident at Nassau gives the following picturesque account of Nassau's natural Marine Gardens: "These Marine Gardens are made up of the most exquisite submerged coral bowers and grottoes, rivalling the choicest productions of the vegetable world in form and colour. One can hardly believe one's eyes when all their unexpected beauties are revealed for the first time. The madrepora, or branching coral, is very abundant, as are also the astræa, or brain coral, alcyonoid polyps (delicate coral shrubs), and algæ, all of which are of fairy form and attractive in colour. Gorgonias and sea-fans, much diversified

in size and colour, and clusters of purple sea-feathers, wave gracefully in the clear water, like flowering shrubs in the wind.

"It would be impossible to imagine any situation better for the thorough examination of a sea garden than that in which we found ourselves on this particular morning. Our vessel was not going fast enough to interfere with the most minute investigation of every object on the sea bottom, and yet just moving sufficiently to enable us to see fresh forms of coral beauty every minute, each more lovely than its predecessor. Into deep alcoves and recesses, under delving masses of coral, did we peer with wondering eyes, almost looking for some Lurline or sea-nymph basking in the sunlight that seemed to penetrate right down into this glorious submerged coral world. The fish that dart about or lie sleeping in these coral caves harmonise well with the general beauty of the scene, for their colouring is gorgeous, and their motions extremely graceful. Some are yellow, some are a rich scarlet; some silver and satin, others ringed, striped, fringed, tipped, or spotted with all the colours of the rainbow. Sponges abound in every direction, clinging to the coral rock."*

Nassau, on account of its beauty and genial climate, has not been inaptly compared to Mentone. It has become quite a fashionable health-resort for American visitors, who flock here, especially during

* "The Land of the Pink Pearl." By L. D. Powles. Sampson Low, Marston & Co.

the months of February and March, when the climate is at its best. In the winter months, from November to May, the temperature varies from 60 deg. to 75 deg., and during the rest of the year, constituting the warm season, from 75 deg. to 85 deg. During the latter season occur the heavy tropical summer rains. The sea bathing here is described as excellent. For those seeking rest and recreation, Nassau may be regarded as an ideal spot. Those who suffer from any form of lung complaint benefit by the curative effect of the climate. It is not an uncommon sight to see walking about persons who ten or fourteen days previously were so ill that they had to be carried ashore from the steamer. The town, it has been remarked, is one of the cleanest in the world, the streets and roads being scrupulously swept and cleaned down every morning. There are many up-to-date buildings, including a well-equipped colonial hotel and well-planned golf-links. One of the interesting features is the old forts, which date from the middle and close of the eighteenth century.

On the occasion of the visit of the Williamson Submarine Expedition, the Governor of the islands, Mr. Hadden Smith, entertained the members of the expedition on a gala day. They were shown the interesting, and sometimes comical, sights of the little town, including the sponge industry, which is the principal business of the island. In honour of the event, the Governor ordered a parade of all the civic and military bodies of the island.

With the exception of the officials, their families,

and a sprinkling of residents, the entire population is native. The Union Jack, which flies from the Governor's residence, is a quiet reminder of the vastness of the British Empire. The town, in addition to the native constabulary and native troops, can boast of several divisions of Boy Scouts.

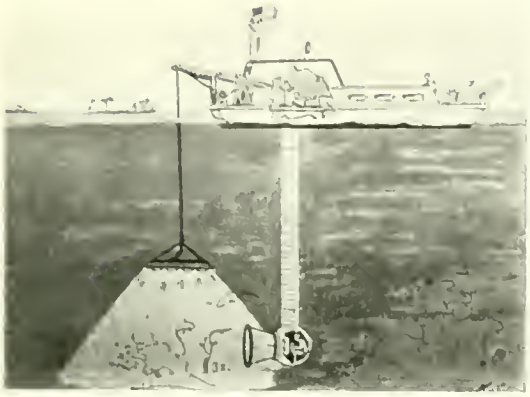
The present Governor, Mr. W. L. Allardyce, C.M.G., we may note in passing, raised three native contingents for service with the troops fighting in the life-and-death world-struggle for right against might, and for freedom against military tyranny.

Nassau, besides its unrivalled Marine Gardens, can boast of several other attractive features. There is, for example, the famous "Queen's Staircase," consisting of nearly three hundred steps hewn out of the solid rock by Spanish convicts three centuries ago, when Spain was in possession of the Bahamas.

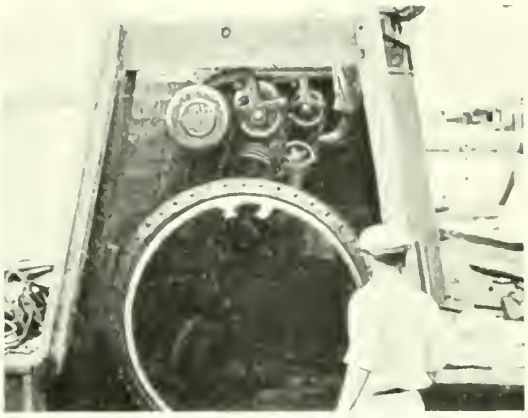
At Nassau can be seen one of the finest examples in the tropical world of the silk cotton-tree. This tree possesses enormous wide-spreading roots, over one hundred and fifty feet in circumference, and these will afford convenient shelter during a storm for no fewer than sixty people. According to the native religious beliefs the silk cotton-tree is regarded as being the dwelling-place of spirits.

In Nassau the native pig, which is small but very spry and energetic, is as ubiquitous as its brother in Ireland. It is quite a family pet, and is at liberty to run about wherever it pleases, but it is not allowed in the house.

Unquestionably, the physique of the Bahama



THIS DIAGRAM SHOWS THE METHOD BY WHICH THE WILLIAMSON SUBMARINE PICTURES WERE TAKEN.



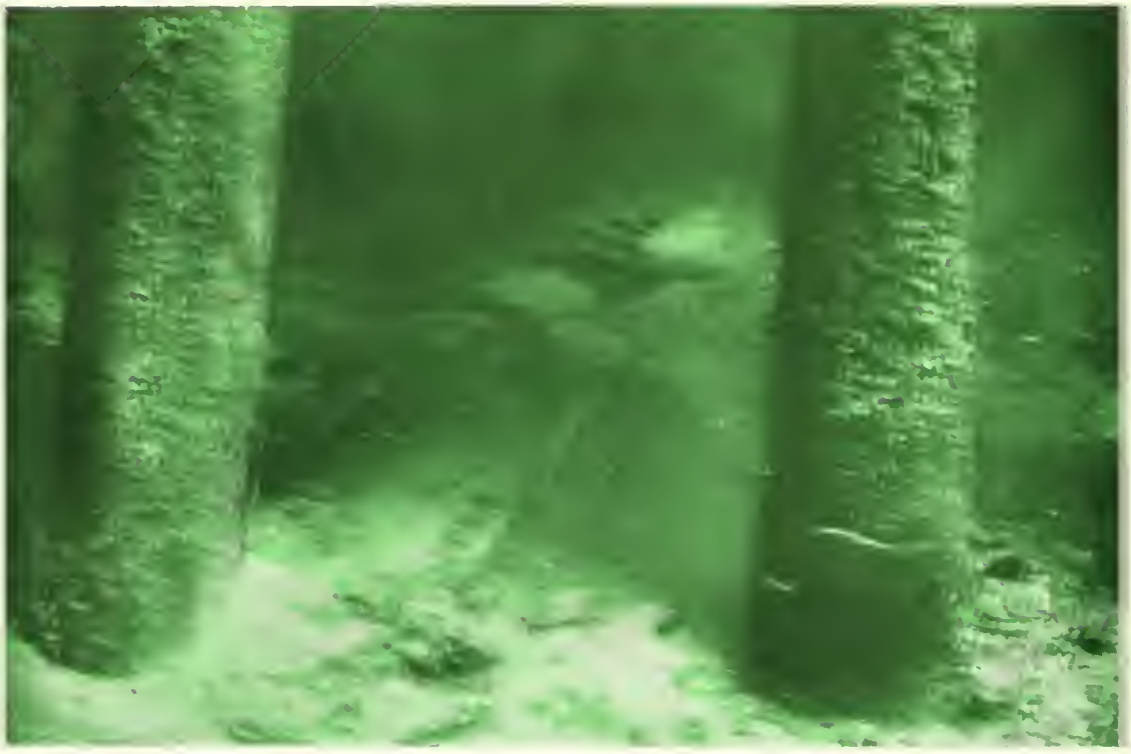
THE OPERATING CHAMBER READY FOR LOWERING INTO THE WATER.

LOWERING THE OPERATING CHAMBER INTO THE SEA THROUGH THE WELL OF THE BARGE.

THE CAMERA OPERATOR AT WORK IN THE OPERATING CHAMBER.

THE GOVERNOR OF THE BAHAMA ISLANDS DESCENDING THE WILLIAMSON SUBMARINE TUBE.

A CLOSE VIEW OF THE OPERATING CHAMBER.



EN ROUTE FOR THE BAHAMA ISLANDS.

A NATIVE WOMAN.

A GROUP OF NATIVE BOYS.

A SPECIMEN OF THE ENORMOUS ROOTS OF THE SILK-COTTON TREE

SPONGE-FISHING. THE NATIVE ON THE RIGHT IS LOOKING THROUGH A BUCKET WITH A GLASS BOTTOM.

AN ANXIOUS MOMENT.

natives is very fine, particularly that of the men. The natives—the term "negro" applied to the black people of the West Indies is strongly resented by them—are exceedingly industrious. Early dawn will find them hard at work in their fields, where they will labour steadily during the whole of the day. They are extremely fond of endearing expressions. For instance, no black woman will wish anyone "Good morning" without attaching the words "my dear." Another interesting characteristic of the natives is their fondness for singing. It does not matter what work they may be engaged in, one or more of them will be singing away right heartily. Sometimes a ditty is improvised by one of the workers, the alternate lines being sung by the others, with a swinging rhythmic chorus at the end. It has been said that they have wonderfully true ears, and are very fond of harmony. The sound of the choruses at a little distance has a most charming effect.

CHAPTER IV.

GETTING READY.

Upon reaching Nassau, the party immediately set to work to build a suitable barge. The construction of the barge, which was forty feet in length and sixteen feet in width, occupied a month. Amidships it contained a well measuring six feet by ten feet, through which the deep-sea tube was to be lowered into the sea. The well was boarded round with heavy, water-tight planks.

When the craft was finished, the party christened it "Jules Verne," in honour of the esteemed French imaginative writer, whose book, "Twenty Thousand Leagues Under the Sea," has charmed thousands of adventurous school-boys, and has delighted many a stolid adult reader who loves to read a romance that is based on scientific facts. To tow the "Jules Verne," the Williamson brothers secured a big gasoline power boat from a native, who also happened, curiously enough, to be an ardent admirer of the charming French writer, and had named his boat the "Nautilus." So, here was the enterprise now fairly started on its way in the real adventurous spirit of "Twenty Thousand Leagues Under the Sea."

The Williamsons had brought with them two immense glass discs, made in France, each one five feet in diameter and one and a half inches thick, for the observation window. They had also provided themselves with a battery of nine Cooper-Hewitt lights, arranged in a gridiron, each light having two thousand four hundred candle-power, these to be lowered for extra submarine illumination, should that be necessary. These artificial lights, however, were seldom used, owing to the wonderful clearness of the West Indian seas even at considerable depths.

The Williamson submarine deep-sea tube, it will be remembered, was described as possessing the dual advantages of strength and flexibility. These were obtained by the use of hundreds of overlapping steel scales or plates, hinged together between annular rings of malleable iron about a foot apart, that form the skeleton of the tube. Over this metallic structure was securely fastened a waterproof fabric of canvas and rubber, the result being a permanently open air-shaft down into the sea, a vertical passage-way into which a man may step from the deck of a steamer, and down which he may climb, exactly as one climbs down a ladder, to a depth of hundreds of feet below the surface.

There is no discomfort from breathing compressed air, since there is no necessity to use compressed air. The top of the tube remains open at the deck level like the top of a well, the sides

and the bottom being strong enough to resist the pressure of the water of the ocean.

At its lower end the tube expands into a spherical observation chamber five feet in diameter, one side of which is provided with a large funnel-shaped window. This observation chamber is made of cast-iron and weighs four tons. In submarine photographic work two persons usually occupy this observation chamber at the same time, one to take the pictures through the heavy glass window, the other to act as look-out and to give orders to the deck crew overhead. A simple ventilating device freshens the air, so that one may remain below for an indefinite period quite comfortably.

The raising and lowering of the observation chamber is controlled by two chains that are attached to the chamber, and run to chain hoists on the deck, which alter the position of the chamber according to the instructions of the observer below. As the tube is lengthened for deeper and deeper lowering into the ocean, its bottom folds are more and more squeezed together under the increasing water pressure, until, at considerable depths, a section of the tube, that would be eleven feet long when fully extended and would weigh a ton, is compressed into about three feet and still weighs a ton. In other words, through this contraction a given length of tube becomes heavier as it sinks deeper, and this automatic adjustment ensures the proper balancing of the tube in the sea.

The apparatus used by the Williamson Submarine Expedition may appear rather simple in construction,

but when it is taken into consideration that it had been perfected only after years of study and experiment, often hampered by difficulties that would have discouraged many, one may get a fair idea of what it meant to the inventor when he discovered that his invention was practical. It had been tested before it was taken to Nassau, but the supreme test of the tube, the chamber, and all the other paraphernalia, came when they took it to strange waters, with the currents of which they were altogether unfamiliar.

It took three or four days for the party to prepare everything for the submarine trip. The first thing that had to be done was to place the observation chamber in position in the shaft, and this was a rather slow process, as the chamber is heavy, and has to be lifted with big steel cranes. Next came the fitting of the heavy glass. This is in one piece, and had to be handled very carefully indeed while it was being fitted to the window. When it was in position, a heavy iron band had to be adjusted over its edge and fastened to the steel grooves on the rim of the chamber, so as to make it absolutely waterproof.

Then came the fitting of the tube, which is made in sections, and is securely fastened together in corkscrew fashion. When everything was in place, one of the members of the expedition went down the tube and saw that all was in readiness in the operating chamber for the camera man and the observer. The camera was next placed in position, and the operator and his companion descended the tube, one at a time, with ropes fastened round their waists to guide their

descent, and to save them in case their feet should make a false step.

As soon as the signal was given to the deck crew by the observer below, the ship began her journey, moving exceedingly slow in order to give the camera man an opportunity of taking pictures of the scenes just in front of him on the bed of the ocean.

CHAPTER V.

TAKING SUBMARINE MOTION PICTURES.

The Williamson party remained at Nassau through the months of April and May, working daily among the neighbouring islands with the "Jules Verne" and the deep-sea tube, and getting good results from the very start. So brilliant was the sun, so crystal clear the water, that, even at depths of eight or ten fathoms, the photographer down in his iron chamber was able to secure marvellous pictures of this strange submarine region, with its vast silences, its waving sea-gardens, scarlet and purple and old gold, and its millions of gorgeous-coloured fishes which darted among the forests of live coral.

It must have been like an enchantment to look out from the observation window over the sea floor, to rise to the marine gardens and the forests of living coral, and descend again to the meadows of the ocean. It must have resembled a spirit land, where all things were at peace.

On favourable days they could see distinctly for a hundred and fifty or two hundred feet ahead of them. Beyond that objects seemed to fade away

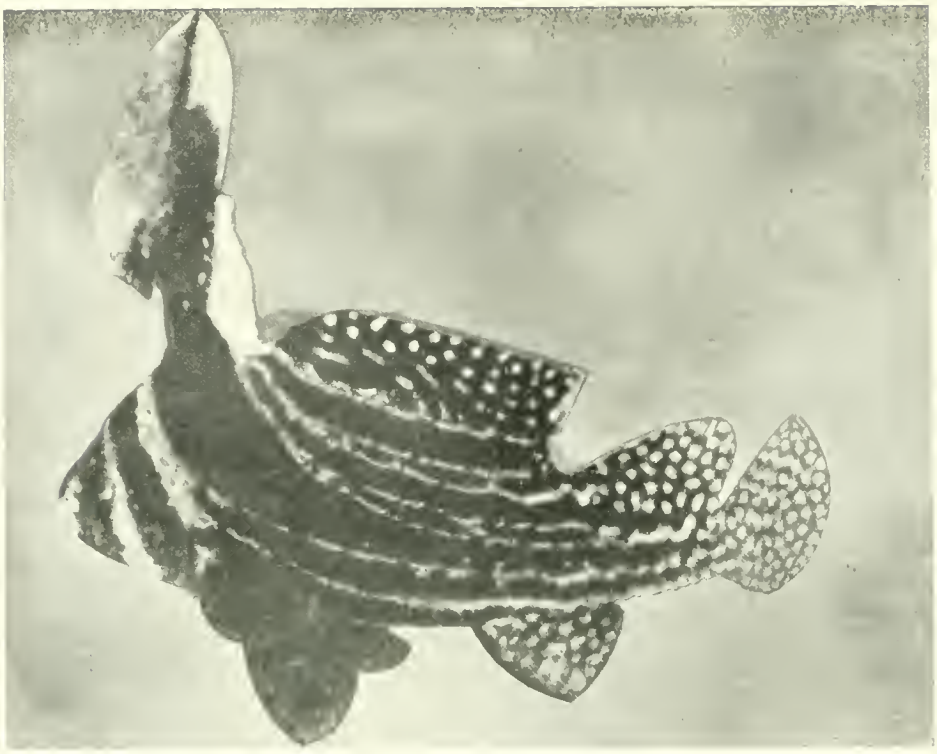
into palest sapphire mist. What a wonderful thing it must have been to look upwards and see the surface waves from below, undulating smoothly with no broken crests. When the sun fell upon the surface its shafts were broken into silver rain that came down to them like fireworks.

Describing the sensation, Ernest Williamson said that he felt as safe down there in the observation chamber as if he had been riding in the luxurious suite of an ocean liner. There was no danger of their five-foot observation chamber being broken by the water pressure, because the pressure of the air on the inner side of the glass is, by means of an air-pump, kept exactly the same as the water pressure outside the glass. An air-gauge and a water-gauge near the funnel show at all times what these pressures are.

The submarine work was carried out as follows: George Williamson and Carl Gregory would usually be in the chamber, down, say, at a depth of fifty feet, George watching the objects and Gregory taking the pictures. Ernest Williamson remained upon deck, leaning over the open tube, listening for orders. It is very easy to talk up and down the tube, in fact, it is just like talking up and down a chimney. George would call out: "Stand by," "Forward," "Aft," "Let her swing," "Slack off," "Now hold on," or whatever he wanted done, and Ernest would repeat these orders to Joe Bethel on the "Nautilus," which was towing them. If George said "Raise her," or "Lower her," Ernest would give word to the men at the chain hoists, and they

MIDNIGHT PHOTOGRAPHY. NATIVE DIVER SWIMMING UNDER THE POWERFUL MERCURY VAPOUR LAMPS.

A VIEW OF THE WONDERFUL FLORA ON THE BED OF THE WEST INDIA SEA.



THE "STARS-AND-STRIPES" FISH, WHICH BEARS A RESEMBLANCE TO THE AMERICAN FLAG.

BABY TURTLES NEWLY HATCHED.

would raise or lower the chamber until George gave the word to stop. Sometimes the party would drift along with the tide, and photograph whatever came within range of the camera.

Some idea may be obtained of the powerful rays of the tropical sun from the fact that they were able to photograph objects under the sea at a distance from the camera of one hundred and fifty feet. In this way the party secured some extraordinary submarine pictures, which amounted to about twenty thousand feet of film. They took native boys diving for pennies and scrambling for them at the bottom of the deep. They took a photograph of George Williamson in his diving suit, searching for treasure near a wreck, while a column of bubbles boiled up from his helmet. They also took a picture of a native diver swimming through a sea forest of palms and ferns, then seated on the bottom of the ocean fanning himself with a purple sea-fan.

Then, just to add the final touch to their adventures beneath the sea, they took pictures at midnight with the aid of their Cooper-Hewitt, which were hung over the side of the ship and lowered down below the surface of the water. They obtained by this means some splendid pictures. One film was of a diver moving among myriads of small fish that swarmed about him, attracted like moths by the electric light. They discovered that a tapping sound on the observation glass would attract the fish, and they could see them turn and listen and then come swimming towards them.

While the expedition was at Nassau the greatest interest was shown in their submarine investigations by scientists and others, and several distinguished persons, including His Excellency the Governor of the Bahama Islands and his wife, gratified their curiosity by paying the Americans a visit and descending the tube to the observation chamber. They were amazed, and marvelled at the remarkable sights that they saw from the observation chamber, and declared that the Williamsons were without doubt the pioneers of a project which would startle the entire world with its wondrous possibilities, and which would one day be worked out to the benefit of the universe.

CHAPTER VI.

DENIZENS OF THE DEEP.

All those who have made a study of the denizens of the deep have been struck with the indescribable diversity and beauty of ocean life. The innumerable specimens that adorn our museums afford some idea, however limited in range, of the colour, form, size, and variety of the creatures that exist in the sea, but hitherto no one has been in a position to study oceanic life in its actual environment, to observe the different creatures seeking for their food, or to watch them fighting their grim battles below the surface of the water.

It is almost impossible to imagine the varieties of form and colour that exist. The brilliant hues which we associate with equatorial bird life seem to have been transmitted to the West India fishes. Here are a few of the many variegated colours: sky blue, deep indigo blue, yellow, blue and black bars, scarlet and crimson, red, plain, dull, and drab colours, dark hued and almost black stripes, recalling the zebra's coat, zig-zag bars and stripes, and spots of all shades. In fact, it is practically impossible to think of any colour or any combination of colours that are not to

be found exhibited by one form of ocean life or another.

"The ocean in its profoundest depths—its plains, its mountains, its valleys, its precipices—is animated and beautified by the presence of innumerable organised beings," writes Louis Figuier. "Among these we find the Algæ, solitary or social, erect or drooping, spreading into prairies, grouped in patches, or forming vast forests in the ocean valleys. These submarine forests protect and nourish millions of animals which creep, which run, which swim among them; others, again, sink into the sands, attach themselves to rocks, or lodge themselves in their crevices; these construct dwellings for themselves; they seek or fly from each other; they pursue or fight, caress each other lovingly, or devour each other without pity. Charles Darwin truly remarks somewhere that our terrestrial forests do not maintain nearly so many living beings as those which swarm in the bosom of the sea. The ocean, which for man is the region of asphyxia and death, is for millions of animals the region of life and health; there is enjoyment for myriads in its waters; there is happiness on its banks."

The majority of the deep-sea animals live by eating the mud, clay, or ooze, or by catching the minute particles of organic matter that fall from the surface. Many of the mud-eating species are of gigantic size when compared with their allies living in the coastal waters, and they themselves become in turn the prey of numerous rapacious animals armed

with prehensile and tactile organs. Some fishes are blind, while others are endowed with very large eyes.

Phosphorescent light plays a most important part in the deep sea, and is correlated with the prevailing red and brown colours of deep-sea organisms. Phosphorescent organs appear sometimes to act as a bull's-eye lantern to enable particles of food to be picked up, and at other times as a lure or a warning. All these peculiar adaptations indicate that the struggle for life may not be much less severe in the deep sea than it is in the shallower waters of the ocean.

Let us now proceed to study in detail some of the wondrous and peculiar creatures observed by the Williamson Submarine Expedition. Certain of these creatures have now been seen and photographed in their native haunts for the first time. Over a hundred little-known fish were photographed, and these have aroused the keenest interest in scientific and photographic circles. Mr. Charles Townsend, the curator of the Aquarium in New York, has spent many hours over the photographs taken by the Williamson brothers, and has found one or two specimens which have never been seen or photographed before. Included among the strangest, the ugliest, and the most beautiful fish, are the cow fish, moon fish, parrot fish, angel fish, butterfly fish, fool fish, scorpion fish, jolt heads, trigger fish, trunk fish, doctor fish, shark suckers, sea horses, squirrel fish, bog fish, and a host of others.

Of course, it will be altogether impossible to describe within the compass of a book of this size all the various animals that were seen and filmed; we

can but select a few of the most interesting and the most peculiar, in order to give our readers some idea, if only a meagre one, of the beauty and diversity of ocean life.

An examination of the foundation of the dock walls, which were constructed some twenty years ago, was made. Much of the foundation was found to be little the worse for its long immersion. But other portions were discovered to have been eaten away to an alarming extent, and it is believed that the destruction of the piles is the work of an extremely small creature called the cobra worm.

The saw fish lives in tropical and semi-tropical waters. The snout, which is exceedingly hard, projects out for several feet. It is flat on both sides, and has along the two edges a number of strong teeth that are sharp in front and flat behind. It provides the fish with a formidable means of defence, for with this weapon it can tear pieces of flesh off its victim, or, if it chooses, rip its prey open. One specimen has been obtained having a saw six feet long and one foot broad at the base. Armed with such a dangerous weapon, the saw fish even dares to measure its strength with a whale, and fishermen who visit the seas where these two ocean potentates encounter each other assert that the meeting is always followed by a combat of the most singular kind, in which the activity of the saw fish is a match for the ponderous strength of the whale. Occasionally the saw fish dashes itself with such force against the side of a ship that its

saw is broken in the timber. In the Natural History Museum, at South Kensington, may be seen the blade of a saw fish embedded in the timber of a vessel. From the length of the saw, it will be gathered that some of the saw fish grow to a large size.

To capture a saw fish is no easy matter. The natives have to be exceedingly wary in the way in which they handle this creature when they have dragged it to the side of the boat, after having harpooned it. With one sudden and unexpected convulsive movement of its formidable weapon it can lop off a man's arm or inflict a very dangerous wound, which, in most cases, is likely to prove septic.

Then, too, there is the sword fish, which is an occasional visitor to the Bahama waters. The sword fish attains a length varying from twelve feet to fifteen feet. Its main characteristic is the possession of a great development of the upper jaw, which resembles a huge, tapering, sword-like weapon, the under surface of which is covered with numerous small teeth. This is a powerful weapon, and the sword fish, like the saw fish, will not hesitate to attack a whale, killing it by repeated thrusts of its sword-like projection. Sometimes, like Don Quixote of old, the sword fish will tilt at large vessels, but this encounter is generally disastrous for the sword fish, the weapon being invariably left behind. Frank Buckland, the naturalist, relates that in the Museum of the Royal College of Surgeons, London, there

is a section of the bow of a whaler impaled by one of these swords. "At one single blow," he says, "the fish had plunged his sword through and completely transfixed thirteen and a half inches of solid timber."

Turtles and tortoises belong to the same family, but the latter name is usually applied to those that live on the land. Belonging to the reptile class of animals, their chief and characteristic feature is the possession of a very strong, bony shell, or carapace, which encases the body, and into which both head and limbs can, in many cases, be completely retracted. Tortoises have normal walking legs, and these fit them for walking on the land or burrowing into the earth. In the True Turtles these limbs assume the form of flattened paddles, and in no instance are more than two of the toes provided with claws. Some of the two hundred known species are adapted for an amphibious life, that is to say, they can live either on the land or in the water. Some, on the other hand, rarely leave the water during the whole of their existence.

Turtles are hatched from eggs, the external covering of which differs from that of a bird's egg in being soft and leathery. A hollow is excavated, usually in a sandbank, and in this the egg is deposited, covered up, and left to hatch with the heat of the sun. As soon as the eggs are hatched the young turtles emerge from the sand and instinctively make for the water. The journey down to the water's edge is fraught with many perils to the young turtle, for fish-

hawks and sea birds of every description are lying in wait to pounce upon it as soon as it makes its appearance. It is said that very few out of eighty or a hundred newly-hatched turtles safely pass through this trying ordeal. Even when they reach the shore their dangers are not over, for here shoals of sharks and various kinds of predatory fish are prowling round in search of the very toothsome morsel which the young turtle will provide.

Certain species of marine turtles attain a remarkable size. Some specimens have measured nearly eight feet in length, and weigh over sixteen hundred pounds.

Tarpon fishing is a delightful sport for American and West Indian anglers. In fact, the tarpon is to them what salmon and trout are to English and Scottish anglers. The tarpon is a fish found near the coast in warm American seas. It attains a length of seven feet and weighs about two hundred pounds. It is angled for with a rod and line. When caught, it makes a desperate attempt to rid itself of the hook, and has been known to leap right over the side of a small boat.

Crocodiles frequent these waters. When hunting the crocodile, the natives lasso the snout and then dive into the water and capture the creature. This, as one can readily imagine, requires a good nerve and exceptional dexterity.

Schools of porpoises disporting themselves are a common sight in these regions. Porpoises are generally harpooned. The harpoon can either be fired from a

gun, which is the modern method, or thrown by hand, but great skill is necessary to do this properly. The porpoise, which possesses a flat tail, is an extremely powerful fish, and when caught will draw a small boat and its occupants through the water for a considerable distance. It is quite an innocent fish, although it does a great deal of damage to the nets of the fishermen, for it follows the herring shoals, gets into the net, and destroys it.

CHAPTER VII.

SOME ODDITIES OF FISH LIFE.

One of the most peculiar creatures to be found on the bed of the ocean is the sea urchin. In some respects, particularly in the possession of spines, the sea urchin resembles the hedgehog, but the movement of the spines is different. Whereas the hedgehog, on the appearance of danger, rolls itself up into a ball and forms a defence with its spines, the sea urchin is able to move its spines about in different directions. Some of the sea urchins bore holes into the hard rocks and remain immovably attached to them. They are frequently attacked by many varieties of fish on account of the ripe bunches of sea urchin's eggs, which are regarded by them as a special delicacy. In their attempts to seize the eggs they are frequently badly wounded, and sometimes blinded by the quills. The sting caused by the spines is very much like that caused by the bee, only it is more painful. In olden times the spines of the echinus—for that is the scientific name of the sea urchin—were powdered and then taken as a remedy for various diseases.

Swarms of snappers were seen by the party.

These varied in colour, the chief being blue, red, and grey. In appearance they somewhat resemble the English mackerel. Off the coast of Florida, in the United States, they are caught in large numbers and are highly esteemed. Snappers display considerable activity in their search for food.

Here is a fish with a curious snout, a glance at which immediately recalls the homely parrot's beak. The teeth of the jaws are joined together in such a way as to form a sharp-edged beak, which gives such a close resemblance to the parrot's beak. This peculiar formation of the beak enables the parrot fish to bite or scrape off those parts of the coral stocks that contain the polyp, or to cut off the branches of the tough seaweed which constitutes the diet of some of the species. Over a hundred different kinds of parrot fish have been recognised by scientists. Being a tropical fish, they display a most beautiful colouration. Some of the parrot fish attain a length of three feet. Many of the species are eatable, and some are highly esteemed; but there are several kinds that are dangerously poisonous.

A curious small fish found swimming about in these waters is the grunt, which has been so named because, when taken out of the water, it makes a strange grunting noise something like that of a pig. Hence they are also known by the names of "pig fish" and "growler."

One oceanic creature possesses a head that bears a close resemblance to that of the horse; hence its

name, sea horse. It can coil up a portion of its tail and firmly attach itself by it to the stem of a seaweed or to some other object. In length, sea horses vary from two to twelve inches, and their colour changes with the general hue of their environment of seaweed.

Occasionally, painted eels, remarkable for their bright spotted and mottled colouration and their size, which ranges from six to eight feet in length, are met with. They are armed with formidable teeth, and are held in no little fear both by fishermen and bathers.

Cat fishes, another species of inhabitants in these and the surrounding waters, are armed with powerful spines which are capable of inflicting serious wounds, either by setting up septic poisoning or causing a violent inflammation of the part of the body that has been lacerated. One of their peculiarities is the absence of scales, their bodies being either entirely naked or armed with bony swellings or overlapping plates. Another characteristic of this species is the presence of sensitive barbels, or feelers, round the mouth, by means of which they procure their food in muddy water.

Scorpion fish are remarkable for their ugliness. They have skinny appendages projecting from their bodies, which resemble pieces of seaweed rather than parts of fish. By means of the wavy motion of these appendages the scorpion fish can either attract other fish, or it can, owing to its likeness to the surrounding seaweed, seek concealment, if attacked. Certain

species of scorpion fish are provided with fin-spines, which are veritable poison organs.

The drum fish are also an interesting species. They are so called because of the extraordinary noise they make. "These sounds," Dr. Gunther writes, "can better be expressed by the word drumming than any other. They appear to be very frequently heard by persons in vessels lying at anchor off the coast of the United States, where these fishes are very common. The precise method by which these sounds are produced is not known. Since they are accompanied by a tremulous motion of the vessel, it seems more probable that they are due to the beating of the tails of the fish against the bottom of the ship to get rid of the parasite with which that part of their body is infested." These fish attain a length of more than four feet and a weight of over a hundred pounds.

A well-known inhabitant of these waters is the sucker, or sucking fish. This species possesses a sucker-like arrangement, placed on the top of the head and extending backwards over the shoulders, By means of the sucker they can attach themselves to sharks, turtles, and any other fish swimming in the sea. Their hold is so strong that it is impossible to dislodge them without exercising a great degree of physical force. They grow to a length of from two to three feet, and usually weigh about eight pounds. The sucking fish are nearly always found in close attendance on sharks.

Barracudas are large voracious fishes inhabiting

tropical and sub-tropical waters, and preferring the coastal waters rather than the open sea. They reach a length of eight feet, and their maximum weight is about forty pounds. Their presence renders the water dangerous to bathers. In the West Indies the barracuda is eaten as food, but this practice is sometimes attended with danger, for, as the barracuda frequently feeds on smaller poisonous fishes, its own flesh may thus be rendered poisonous.

The trigger fish is so called on account of the possession of an armature of spines on the top of the back. These spines are three in number, and the first one resembles the surface of a file. Hence this fish is sometimes known as the file fish. The trigger fish has the power of raising and lowering these spines at will; hence the appropriateness of the name. Their teeth are so powerful that they can easily break off pieces of hard coral, which forms a large part of their diet. They do a considerable amount of destruction amongst shell fish and pearl oysters. As they frequently eat poisonous coral or jelly fish or decomposing substances, their flesh, too, becomes poisonous.

In these tropical waters are to be found zebra fish, so named on account of their curious black stripes, which give it the appearance of a zebra's coat; angel or monk fish, which possess a broad flat head, and attain a length of five feet; the Hanna fish, a light blue fish, named after Hanna, a scientist; the convict fish, whose scales bear peculiar marks, reminding one of a convict's dress; the butterfly fish, which bears

a close resemblance, in the markings on their skin, to the butterfly; and the swallow-tail fish, whose tail, as its name implies, resembles that of the swallow.

One species of fish discovered was unique in its way. The markings on the skin resemble the Stars and Stripes of the United States flag. No native has ever been able to capture this fish, and scientists at Washington have, ever since the Williamson Submarine Expedition, been puzzling over the pedigree of this wonderful creature, for no one had ever seen such a fish before. The expedition nicknamed it "Old Glory." When "Old Glory" was being photographed under the water, it was noticed that all the other fish gave it a very wide berth. The reason for this strange procedure is at present unknown.

Shell fish of all kinds abound in these waters, as one would naturally expect. Huge conches, or shells, containing about five pounds of delicious and nutritious food, are obtained without much difficulty.

A PORPOISE CAPTURED BY THE EXPEDITION.

A CROCODILE'S HEAD.

CAPTURING A SAW FISH.

CAPTURING A SHARK BY BAITED HOOK.

NATIVE WITH A CAPTURED TURTLE.

HAULING A PORPOISE ON BOARD.

A NATIVE TYING AN ANCHOR ON THE BED OF THE OCEAN.

CHAPTER VIII.

SPONGE FISHING.

PRACTICALLY everybody is familiar with the common sponge, as there are few families or individuals, living in civilised countries, who do not use it on various occasions. So very useful has this ordinary everyday article become that we should experience no little inconvenience if for any reason we were unable to obtain it. What would the surgeon, for example, do without it when he is performing an operation? What would the housekeeper do? How much less should we enjoy our bath if the sponge were not available! And yet, despite the fact that a sponge is to be found in almost every household, how many people know what a sponge really is?

It has become so much an article of everyday use that we never trouble to ask ourselves concerning its origin, its pedigree, or its home. If you were to ask anyone this question: "What is a sponge?" you would be met with a blank look of amazement, because very few people have ever read anything about the sponge. Some would probably be able to state that sponges are obtained from the bed of the sea or ocean, and their knowledge would, no doubt, be limited to that single fact.

What is a sponge? For a great many years this question puzzled scientists, and for a long time the sponge was regarded as being a form of plant life. There appeared to be good reasons for classifying it with the vegetable world, because, in form, the sponge is in many ways like a plant, and also because it is fixed to a particular spot just as an ordinary plant is kept in a certain position in the soil by means of the root.

It was not until the year 1829 that a scientist, named Grant, carried out a number of careful observations of the habits of these remarkable creatures, and discovered their method of feeding. His investigations of sponge life led him to assert that sponges, although fixed to one spot, really belong to the animal and not to the vegetable kingdom. Since then, further scientific observations have been made and their structure has been closely examined, so that nowadays scientists are fully agreed that sponges must be classified with the lower forms of animal life.

One end of the sponge is fixed to the bed of the sea, while the other end is open. This opening is known as the osculum. The walls of the sponge are penetrated by innumerable small canals. Currents of water, passing through the smaller pores and out at the larger openings, contain a variety of still lower forms of life on which the sponge makes its meal.

In its natural state, on the floor of the sea or ocean, the sponge is a living thing, but the sponge that is sold as a commercial commodity is but the framework or skeleton of the original living creature. When

the sponge is alive the skeleton is coated with a sticky kind of matter of a gelatinous nature, and before the sponge can be of any marketable value this soft, sticky portion must be entirely removed. There are various ways of doing this, according to the locality in which the sponge is found. In the Bahamas, for instance, the soft animal matter is beaten out by the natives with flat pieces of wood that resemble small paddles.

There are now known to be no fewer than one hundred and fifty different kinds of sponges. These, however, may be grouped into two main classes, namely, the common sponges, which are rounded or flat in shape; and the finer sponges, which are concave or cup-like in form.

Sponges assume all kinds of shapes. Some are like a beautiful vase, others are semi-cylindrical, while others, again, are nearly flat, like an open fan. In some cases the shape of the sponge bears a likeness to an open hand; these are known as glove sponges. Sponges are found very abundantly in tropical or semi-tropical waters, the most noted sponge centres being certain parts of Australia, the Mediterranean Sea, the Red Sea, the West Indies, and the Bahamas. Certain kinds of sponges, but not many, grow at an extremely rapid rate. These have been known to reach a diameter of a foot in so short a period as five months. Others, on the contrary, grow exceedingly slowly. Many sponges attain an enormous size. The Williamson Submarine Expedition obtained several photographs of the monster tub sponge, which grows

to a height of nearly ten feet. As these sponges have no commercial value they are invariably left growing undisturbed.

In the Bahamas the sponge fisheries are carried on entirely by the natives. The sponge fleet consists of a variety of small vessels, and will often sail a distance of ninety miles from the islands. Each boat has on board a peculiar type of cooking box, in which the food for the crew is prepared, and these cooking boxes, it is strange to say, are exactly the same as those used by the sailors of Columbus' time, over four hundred years ago. They are filled with sand, on which a fire is constructed. From twenty to thirty men, women, and children make their homes on one of these boats during the sponge season. A sponge fishing trip usually lasts about six weeks.

The native fishermen are each provided with a bucket having a glass bottom, and a thirty-foot grappling-pole containing a set of strong iron hooks at the end. The position of the sponge is located through the bucket, and then the fisherman seizes it by means of his grappling-pole. Sometimes the roots of the sponge run through the bed of the sea for some distance, and then the native has the greatest difficulty in tearing away a portion of the sponge. While this is being done a number of different kinds of fish gather round the spot, anxiously waiting to seize any food that they can find as soon as the sponge has been torn away.

In some parts of the sponge beds the divers descend to the ocean floor and tear the sponges off.

As one would naturally expect, this work frequently entails considerable danger to the native diver.

Some of the finest qualities of sponge are to be found in the Bahama Islands, the principal depôt being at Nassau. But others, possessing a greater degree of coarseness, are also found, and as these are cheaper than European sponges, the process of preparation of the coarser qualities is not so careful. Sponge fishing in the Bahamas, which gives employment to six or seven hundred vessels and about five thousand men, is carried on in the enormous beds that lie to the east, west, and south of the island of New Providence. Although often far from the shore, and at a depth varying from twenty to sixty feet, the sponging ground can be descried quite easily through the transparent waters on the clear, sandy bottom, from which the sponges are raked or grappled up. From William's Cay and Andros Island the finest qualities of sponge are obtained. The superior kinds of sponge are most serviceable for surgical purposes, and when prepared are generally despatched to America.

The cleaning of the sponge is quite a simple operation. The sponge is kept on the deck of the boat until it is dead, and then it is thrown into a "crawl," which is an enclosure of wattle specially made for the purpose. Here the sponges are left to soak for four to six days, during which time they are repeatedly washed by the tide. After this they are taken out of the "crawl," and, as we have already said, beaten with flat pieces of wood re-

sembling paddles. At one time it was customary to bury the sponge in the sand for nearly three weeks to enable the insects to eat away the soft gelatinous matter. But the modern method is preferable, for it is quicker, more simple, and cleans the sponge better.

Now the sponges are taken ashore, and here men and boys sort them out according to size and quality, but the natives, it may be mentioned in passing, are not very good judges of the quality of the sponge. When this has been done, the next operation consists of cutting the sponges into various shapes and removing all the irregularities. Much of this work is performed by native girls and women, and it is most amusing to see the women puffing away at an old, short, clay pipe and to hear them singing hymns. The next step is to pack the sponges into bales for shipment. As soon as this is done, a specimen sponge is fastened outside the bale as an indication of the quality and size of the contents.

But even after all this has been done, the sponges are not yet ready for sale. Before they can be placed on the market they are pressed and washed a great many times in salt and fresh water until every trace of the soft animal matter has disappeared. When these processes have been accomplished the sponges are passed through boiling water with the object of ridding them of the peculiar smell inseparable from the presence of animal matter. At some centres the sponges are bleached by steeping them in a

dilute solution of sulphuric acid, in which they are allowed to remain for five or six days, care being taken to press them from time to time. This process certainly imparts a better colour to the sponge, but it considerably impairs its durability. Very often sponges are "loaded" by the addition of such substances as rock-salt, molasses, gravel, and sand, in order to increase their weight. Of course, this is done only by unscrupulous merchants and sponge dealers.

The following vivid and descriptive account of sponge fishing in the Bahamas, and the sponge industry to which it gives rise, written by an eye witness, Mr. Henry A. Blake, at one time Governor of the Bahama Islands, is worth reproducing here:—

"From October to July the sponging season is in full swing. There are over five thousand men and boys engaged in the fishery, each schooner carrying a crew of five to seven. The sponges are found all over the banks, which vary in depth from two to four fathoms. The fishing is managed on the share system, the crew being thus directly interested in the success of the voyage, which lasts about six weeks. Arrived on the ground, the small boats, of which each schooner carries two or three, put off, manned each by two men, one of whom sculls, while the other, armed with a thirty-foot pole, bearing at the end a double hook, lies extended over the bow, and examines the bottom through a "sponge glass," or bucket with a glass bottom. Laying this upon the surface, everything below is seen as clearly as if no water intervened.

Even in fifteen and twenty fathoms the bottom can be clearly seen and examined. The sponges, when found, are hooked up by the armed pole, and as soon as the schooner's deck is filled she sails away to a "ranche," where she deposits her now evil-smelling load in a "crawl," or enclosure of wattles in shallow water, where it remains for a fortnight, during which the crew are fishing for a fresh cargo. On their return all hands enter the "crawl" and beat out the now rotted fleshy part of the sponge, which, when first gathered, presents the appearance of a round mass of dark india-rubber freely perforated. When the fleshy part has been thoroughly removed and the marketable skeleton washed, the heap is laid on shore in a secluded spot, while the lot that has taken its place remains on the "crawl," and the schooner starts again for the sponge banks. At length, enough has been gathered and cleaned to load the vessel, when the sponges are sorted by the crew into glove, reef, lamb's wool, grass, etc., and each kind separately strung in rings of from one to two dozen. In this way they are sold by auction in the sponge exchange, when the first step of the preparation for the consumer is carried out by the sponge merchants. The sponges are exposed to the sun to improve the colour. They are then clipped of all irregularities, and pieces of shell or rock removed by the clipper, and once out of his hands they are, so far as the Bahama sponge merchant is concerned, ready to be pressed into bales and exported."

Bahama sponges are classified into eleven different

kinds. The bath sponge—the fine, large lamb's wool or honeycomb sponge—is found in certain localities. This is very valuable and finds a ready market. Other kinds of sponge include the reef, the boat, the velvet, the yellow, the hard head, the grass, and the common or glove sponge. With the exception of the velvet sponge, none of these kinds is of much value from a commercial point of view. Some of the coarser kinds of sponge find their way into the stables.

Very seldom are new sponge grounds searched for. Sponge fishermen seem to prefer the old and familiar beds, and consequently these, after a time, become worked out. Undoubtedly, in these waters may be discovered vast new sponging beds, which may prove to be valuable sources of future wealth to the islands.

Most people are under the impression that the use of sponges is confined to toilet and surgical purposes. This, however, is far from being the case. Many of the coarser qualities are gradually being utilised in other ways. In America, for instance, sponges have been used for stuffing beds and furniture. Probably, in the near future, the cheaper kinds of sponge will be utilised for a variety of purposes little dreamt of now.

CHAPTER IX.

THE CORAL ARCHITECT.

At one time or another most people have seen a piece of coral, either in the form of a child's pretty plaything, or a girl's trinket, or as an attractive curiosity in a museum. From remote times coral has been valued as bracelets, chains, and brooches, as a personal ornament, or for decorative purposes. In bygone ages it was regarded as endowed with certain mystic and sacred properties, and for this reason became exceedingly popular with many classes as a potent charm against evil spirits, and accidents, serious illnesses, or misfortunes of any kind. The Romans, it is recorded, used to hang beads of red coral on the cradles and round the necks of infants to "preserve and fasten their teeth," and also to save them from the "falling sickness." In China, a special kind of coral always commands a high price, because this is in great demand for buttons of office worn by mandarins. There, too, coral is powdered and used as a medicine and also as a cure for inflammation of the eye.

Coral is, after pearls, the handsomest and most valuable of all the products obtained from the sea.

It will polish with the brilliancy of a gem and shine like garnet. It is very durable. Some of the larger branches of coral are used for carving, and from the workshops of Naples, Genoa, and Leghorn, in Italy, comes the finest and most artistic work in carved coral.

Worm-eaten coral beads find special favour with the natives of India, owing to a superstitious belief that gods dwell in the little recesses or cavities.

What is coral? Little was known for a long time about the habits of the coral, its classification, and its method of growth. But now that the coral has been closely studied, we are in possession of a number of scientific facts. The coral that you see exhibited on a shelf in a museum, or forming a charming necklace or other ornament, is merely the skeleton of a once-living animal. This skeleton is as hard and brittle as stone, and is the part of the coral that is used for commercial purposes. In the natural state, the skeleton is covered with a soft substance that, when fresh, can be scraped off quite easily with the nails of one's fingers. There are holes in the soft portion of the coral, out of which protrude little flower-like arrangements, which have been compared to sea nettles. The coral polyp, as it has been called, is not a flower, but a small animal. Food is conveyed to it by means of the currents which pass through the pores or small openings.

The structure of these little creatures is thus

very simple; they present the appearance of a pocket or open purse, the mouth being surrounded with tiny tentacles, or feelers, and conducting to the central portion of the polyp the food that is carried by the current that enters it.

So peculiar and fantastic is the coral scenery on the sea bed, that one fancies oneself in a land of fairy enchantment. Here is a description of some fairy grottoes which will help you to form a mental picture of the delightful scenery on the bed of the ocean. "You look down, and see a steep, irregular wall, extending deeper into the ocean than the eye can follow, and broken into lovely grottoes and holes and canals, through which the resplendent fishes of the brightest blue or gold flit fitfully between the lumps of coral. The sides of the natural grottoes are entirely covered with endless forms of tender-coloured coral, but all beautiful, and all more or less of the fingery or branching species, known as madrepores. It is really impossible to draw or describe the sight."

There are various kinds of coral, as well as nearly every variety of colour. The fan coral is so called because of its resemblance to that article formerly in great favour with ladies. Sometimes this specimen of branch coral looks like a dwarf tree on the top of a hill. Some corals take the form of palms, which bend to the current as it sweeps onwards; others are something like a whip in shape. Brain coral is to be seen in the West Indian seas; this kind has been so named because in shape it bears a wonderful resemblance to

the human skull. Then there are stags' horn corals, which remind one of the arrangement of the antlers on a stag's head. Another kind is the star coral, whose name is self-explanatory. The organ pipe coral takes its name from the regular arrangement of its cylindrical dark crimson tubes side by side.

Coral may be red, white, pink, black, pale yellow, purple, green, or brown. Red coral is found extensively in the Mediterranean Sea, and is exported to India and China, where it is largely used for ornamental purposes. From the commercial point of view the most valuable coral is the rose-pink. This quality of coral will be sold for as much as £100 or £120 a pound, whereas the same quantity of ordinary red coral will fetch only about £2. Black coral is found principally in the great Barrier Reef of Australia. At Jedda, in Arabia, there is a black coral fishery which extends fifty miles north and south.

The word "coral" carries our thoughts "far from home to fair isles in tropical seas—isles connected in our memories with tales of shipwrecked mariners and hair-breadth escapes, of dashing waves and peaceful lagoons, of bread-fruit trees and waving palms, of perpetual sunshine and endless holidays, of Robinson Crusoe adventures and interesting islanders, of poisoned arrows and ferocious sharks."

Coral is found all over the world: in the Mediterranean Sea, in the West Indies, in the Fiji and other Pacific Islands, out in the Atlantic, and off the north-eastern shores of Australia.

Have you ever wondered how the beautiful coral reefs, of which you may have heard, have been constructed? The way in which they have been formed is not at all difficult to understand. The coral, while it is alive, secretes a substance called carbonate of lime, and has the power of depositing this chemical compound in solid masses. Now, the coral polyp, instead of living inside this mass, as one would expect it to do, after the manner of shell fish, prefers to live outside, clothing the hard substance with a kind of soft, transparent jelly. The co-operative principle underlies all the actions of the coral polyp: they live and work together in communities, and as time goes on the amount of carbonate of lime secreted accumulates, and, while doing this, assumes different forms, often, indeed, branching out in various directions, as a tree does when it is growing.

After a time the coral polyp, having lived its full term of existence, dies, and presently the soft portion of the animal decomposes and is washed away by the moving water, leaving behind the hard, stony skeleton. Parts of this skeleton mass are broken off from time to time by the currents, or the waves, and the loose blocks of coral are frequently flung with considerable force against the mass, breaking off other portions, and gradually grinding a great deal of this into fine coral sand, which eventually fills the numerous holes and crevices. In the course of a long period the whole mass thus becomes cemented into hard reef rock,

and in this way a kind of island is formed down on the ocean bed.

This is always going on, and thus the low island gradually rises through the addition of further rock material brought to it by the ocean waves and currents, until at last the reef has grown as high as the surface of the water.

Before long the reef becomes covered with a layer of soil, which is washed on to it by the waves. The seeds which this soil may contain, and those which may be dropped on to it by the birds, germinate, and not very long after varied forms of tropical and sub-tropical plant life begin to make their appearance, and in this way the coral island, originally quite bare, is clothed with a most luxuriant vegetation. In some instances the original island has completely sunk below the level of the water, leaving the fringe of a reef surrounding a central lagoon. Charles Darwin, one of the most eminent scientists of the nineteenth century, made a special study of the structure and distribution of coral reefs. He has described the lagoon islands, or atolls, as they are called, as "vast rings of coral rock, often many leagues in diameter, here and there surmounted by a low, verdant island, with dazzling white shores, bathed on the outside by the foaming breakers of the ocean; and on the inside surrounding a calm expanse of water, which, from reflection, is of a bright but pale green colour." He further adds: "The naturalist will feel a deeper astonishment after having

examined the soft and almost gelatinous bodies of these apparently insignificant creatures, and when he knows that the solid reef increases only on the outer edge, which day and night is lashed by the breakers of an ocean never at rest."

CHAPTER X.

DEEP-SEA DIVING.

DIVING, whether in shallow water or in the deep sea, is ever a fascinating occupation, and the latter probably more so than the former. Not only has diving an element of fascination, but it also has the merit of antiquity. In the "Iliad," one of the world's oldest literary masterpieces, diving for oysters is mentioned, and Thucydides, the Greek historian, alludes in his writings to the work performed by the divers who, during the siege of Syracuse, sawed down the barriers that had been constructed below the surface of the water by the enemy with the object of wrecking any Greek war vessel attempting to force an entrance into the harbour. In ancient Rome divers were frequently employed to salvage sunken property, and in some cases they were allowed, as a kind of perquisite, a definite proportion of the value of the wreck salvaged, the amount paid varying according to the depth of the sunken vessel and the risks incurred during the salvage operations.

In many parts of the world the primitive method of diving is still in vogue, as, for example, in the

Ceylon pearl fishing grounds, in the Mediterranean sponge fisheries, and in the Bahama waters.

Deep-sea diving is, as one would expect, exceedingly exhausting and trying work. Sometimes the strain on the diver is so severe that blood oozes from the nose, the ears, and the mouth, and when this happens the diver is not infrequently dragged back to the boat in an insensible condition. Slight men of muscular build, with good circulation, sound hearts, steady nerves, and temperate habits, make the best divers. "How long can a diver remain under water?" is a question often asked. Well, this, of course, depends on each individual diver, some divers being able to stand a greater strain on their system than others. So far as authentic records are available, the longest time that a diver has been known to remain below the surface of the water is three minutes.

Many different expedients for diving have been tried or adopted at various times; in fact, the history of deep-sea diving is intensely interesting. One method commonly employed in connection with pearl fishing and sponge fishing is for the diver's body to be well rubbed with oil, and the ears protected by the insertion of a plug of wool saturated with oil.

The number of times that the Ceylon pearl divers will descend into the water in a single day is not more than thirty or forty. The means taken to descend is to lay hold of a rope with one hand, and to insert a foot in a loop

made in another rope to which a heavy stone is attached, with which the diver sinks to the bottom.

The idea of supplying the diver with air while he is under the water dates back to the sixteenth century. In an old book written during that period there is an engraving representing a diver wearing a light-fitting helmet, to which is attached a long leather pipe leading to the surface of the water. By the use of a bladder the open end of the tube was kept above the level of the water. It is thought that this idea was suggested to the inventor by the action of the elephant in keeping its trunk above the water when it is crossing a river.

About a century later an apparatus was evolved in which air was forced down to the diver by means of a large pair of bellows. This possibly suggested the air-pump, that was afterwards employed for supplying the diver with air, and which is still the method adopted in the majority of instances.

Early in the nineteenth century, a Devonshire man, John Lethbridge by name, invented a "water-tight leather case for enclosing the person," and this invention of a simple diving suit was the prototype of the modern diver's dress. Made of leather, and containing an ample supply of air, the diver could, by the use of this suit, freely move his arms and legs, and walk along the bottom of the sea. Lethbridge, it is believed, made a considerable sum of money out of his clever invention.

A modern diving suit is a model of ingenuity and skill, every device and precaution being taken to ensure the safety of the occupant. The diver puts on the lower part of his elastic, water-proof, rubberised suit like he does a pair of trousers. A highly-planished copper shoulder-piece fixes tightly to the shoulders, and thus forms a firm base for the helmet. When this has been donned, the helmet is adjusted very carefully to the breast-plate, to which it is fastened by means of metal screws. After the diver's boots, each of which, by the way, has a lead or gun-metal sole, and weighs from fourteen to sixteen pounds, have been buckled on, the diver is in an air-tight suit, which envelops his body from the neck to the toes. The sleeves, it may be added, are made in such a way that they form a water-tight joint at the diver's wrists.

The helmet, which is the last part of the diving suit to be adjusted, is provided with a flexible air tube, through which air from above is pumped to the diver by means of a pumping machine, usually worked by hand. It also contains an arrangement by which the foul air breathed out by the diver can escape, and when the diver is under water this can be seen issuing in the form of a series of bubbles. These bubbles are very anxiously watched by those on board, for their regular appearance affords an indication that all is well with the diver. Should they, from any cause, cease to appear, this shows that something has happened, and the diver must be raised to the surface at once. The helmet is generally provided with three

eye-holes in front, covered with glass, and protected by strong guards made of brass wire.

A diver is further supplied with a life-line, as it is called, made of stout manilla rope, which he always holds in his hands. With this line he can signal to those on deck, in accordance with a pre-arranged code. The life-line has also the advantage of serving to guide the diver in returning to the ladder by which he descends and ascends. Modern diving suits, it may be interesting to note, are supplied with a telephone apparatus, and this enables the diver to keep in close telephonic communication with the men on board.

The above is a simple description of the diving suit in common use. Of course, there are different kinds of diving suits, each having certain modifications and improvements. One type of diving suit, for example, contains an arrangement that enables the diver to obtain his own supply of fresh air, and thus avoids the necessity of his depending on the air supplied to him by the air-pump. The cost of a modern diving suit varies from £75 to £200.

Before the diver is ready to descend into the water a number of weights are adjusted across his chest and back in such a manner that they cannot possibly become detached. These are necessary to enable him to descend with facility to the depths of the ocean and walk about the floor of the ocean, and also to permit him to maintain his equilibrium while he is below. Every diver wears a heavy

waist-belt, in which he carries a strong knife in a metal case for emergency purposes, and sometimes any other small tools that may be essential for the particular task he has in hand.

The greatest depth to which any diver has been known to descend is one hundred and eighty-two feet. Those engaged in the Mediterranean sponge fisheries frequently descend to a depth of one hundred and fifty feet, while the pearl divers of Australia go down a hundred and twenty feet.

For special kinds of work, such as laying the foundations for bridges, breakwaters, etc., the diving bell is employed. This consists of a cast-iron box without a bottom, and weighs about five tons. The top of the diving bell is supplied with stout glass windows, so as to admit the light, and also with a connection into which the air supply pipe, which is connected to a force pump, is screwed. Inside, the bell is fitted with two seats and a suspending chain, to which immense stones or concrete blocks can be attached. The bell is suspended from a barge, or platform, by chains attached to the top, and is used in from thirty to thirty-five feet of water.

In addition to its scientific and photographic value, the Williamson deep-sea tube has many other practical applications. One has only to read the list of treasure ships which foundered in fairly shallow water to realise what a fascinating field of profit is here. Millions upon millions of pounds

in coins, gold and silver bars, ivory and precious stones, and valuable jewels, have gone to the bottom of the ocean by the foundering of treasure-ships. Most of this treasure has been given up as lost for ever to the world, but the Williamson apparatus is a hint that much of it may one day be recovered.

During their exploration of the sea bottom, the Williamson brothers located an old wreck, which it was afterwards ascertained was that of one of the vessels engaged in blockade-running during the American Civil War. Mr. George Williamson arranged to descend for a closer examination and inspection of the submerged wooden vessel. This was by no means an easy task, for while he was exploring the ship, on which he had great difficulty to maintain his equilibrium, he was working under the pressure of two atmospheres. This means that there was a pressure of about thirty pounds on every square inch of his diving suit. After some trouble, he managed to wrench off the ship's bell, which, after examination, was found to contain a Spanish inscription, and then, with his hatchet, chopped off a piece of the wreck to keep as a souvenir of his exploit.

At the present time the Williamson brothers are at work on an expedition to salvage the "Mereda," wrecked off the Virginian coast a few years ago, with a large quantity of silver ingots and jewellery. The majority of the great wrecks of history are to be found in water much shallower than the extreme length of the present tube, because shipwrecks nearly

always occur near the shore. Among the many famous wrecks to be salvaged, apart from those lost during the war, there are the "John Grant," which went down in fourteen fathoms of water off Orkland Island, with a quarter of a million in gold on board: the "Lizard," sunk near Cornwall, with fourteen million pounds in gold; the "San Pedro," sunk off the Central American coast with a large cargo of gold and precious stones, valued at about thirty millions. And then there is that famous fleet of Spanish galleons sunk in Vigo Harbour, in which twenty million pounds in gold and silver were lost. Not one per cent. of this and much other treasure has ever been recovered, and there are thus enough wrecks at a depth to which a man can descend at present to keep divers and treasure-seekers busy for a hundred years to come.

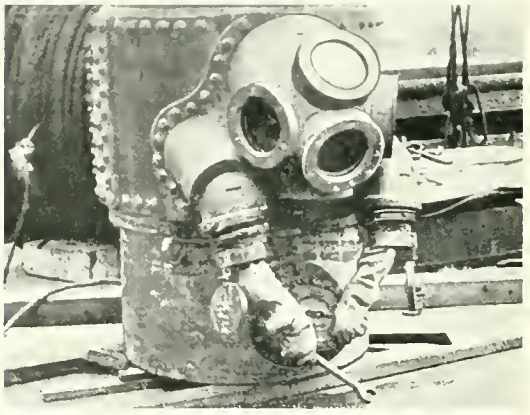
The great feature of this invention is that the tube will allow the bottom of the sea to be surveyed where the depths are not *too* great, and for the diver to stay down there comfortably breathing good air. The adaptation of the apparatus to any moderate depth is merely a matter of engineering detail, which can be worked out without any difficulty. From one of the illustrations accompanying this chapter it will be seen that the apparatus includes a device enabling objects to be picked up from the ocean bed. Utilising this, how easy it would be, for example, to load sponges and pearls into lowered baskets, if you had the sponges and the pearls right before your eyes. And the same thing applies to bars of silver and chests of gold.

EXPLORING A WRECK LYING ON THE BED OF THE OCEAN

NATIVE TYING AN ANCHOR TO THE OCEAN BED.

MR. WILLIAMSON EXPLORING A PORTION OF A WRECK.

MR. WILLIAMSON ABOUT TO DESCEND INTO THE WATER.



DIVING CHAMBER, WITH ARM HOLES, INVENTED BY CAPT. WILLIAMSON TO FACILITATE THE REMOVAL OF OBJECTS FROM THE BED OF THE OCEAN.

A DIVING SUIT.

THE RETURN OF THE DEEP-SEA DIVER.

A NATIVE DIVER CARRYING A KNIFE IN HIS MOUTH.

MR. ERNEST WILLIAMSON READY TO ATTACK A SHARK. THE CARCASE OF THE HORSE IN THE BACKGROUND WAS USED AS A BAIT.

MR. ERNEST WILLIAMSON AWAITING AN OPPORTUNITY TO MAKE A DIVE.

ATTACKING A SHARK.

MR. ERNEST WILLIAMSON READY TO MAKE A DIVE.

A CLOSE VIEW OF A SHARK'S HEAD.

A NATIVE ATTACKING A BLUE SHARK.

CHAPTER XI.

A THRILLING FIGHT WITH A BLUE SHARK.

The large blue shark that infests the waters surrounding the West Indies is the most dreaded of all the monsters of the deep. Its length varies from twelve to fourteen feet, and its weight from four hundred to five hundred pounds. The mouth of the shark is provided with a series of sharp, triangular teeth, which bend inwards, so that the victim, once caught between the shark's jaws, has no possible chance of escape. As soon as the shark rises to take the bait, the skilful harpoonist throws his weapon, which penetrates the flesh of the shark just as it is about to make off with the bait. In order to try to get rid of the harpoon, the blue shark follows the curious practice of turning over and over in the water very rapidly, but, unfortunately for the victim, instead of this ridding it of the weapon, its body becomes scored by the rope with which it entwines itself.

"These Ishmaels of the deep," writes one who knows the Bahamas well, but is anxious to clear the shark of the unenviable reputation it has acquired, "have such a villainous reputation that it would be useless to attempt to change it, but I

must confess that, as far as our experience went, they were 'not so black as they are painted.' It may be that even sharks acknowledge the mild influence of the climate, and that the benignant atmosphere of the land of eternal afternoon has, like music, 'charms to soothe the savage beast'; for certainly in the Bahamas the shark appears to be a cowardly fish, and unless impelled by hunger rarely assails a human being, except first attacked. Instances of their devouring the bodies of people who have been drowned are frequent, but we did not hear of any case in which any living person had been taken by a shark. Personally, we found the sharks really forbearing creatures. On one occasion some members of our party, including two little boys, who would have been toothsome morsels for a shark, were bathing in the harbour close to the barracks. A soldier was observed shouting and gesticulating, but my husband failed to catch what the man said. On leaving the water, he learnt that the soldier had been trying to caution him about the vicinity of a large shark. The small boys had heard the man cry 'A shark! A shark!' but had maintained a judicious silence about it, as they were afraid of being made to leave the water sooner than usual. This shark was killed a couple of days afterwards, and measured fifteen feet in length.

"One of the most singular instances of the voracity of the shark was related to us by a gentleman on whose testimony reliance may be placed. At a

little distance from the town of Nassau there is good sport catching 'Black Fish,' as they are locally termed. These fish are found in deep water, so that it is necessary to play out sixty fathoms or so of line; on hauling up, it is often tantalising to find that a shark has been beforehand and taken the prize off the hook. On one occasion this happened so frequently that, in order to secure some fish and get rid of the robber, the men let go a shark hook and soon captured a large shark. They cut the unhappy creature open, extracted the liver (which contains a considerable quantity of oil), and flung the carcase overboard. In another few minutes there was a tug at the hook, and to the no small surprise of the fishermen, they brought up the very shark they had just thrown away as dead."

Certain kinds of sharks are eaten as food by some of the poorer classes of the people. Sharks are useful for many purposes. They supply an inferior kind of oil, and their skin, under the name of "shagreen" is made extensive use of by cabinet-makers for smoothing and polishing wood. In some parts of the world the dried fins of the shark form an important article of trade, the Chinese, for instance, preparing gelatine from them.

One of the strong desires of the Williamsons was to take motion pictures of a shark in its native haunts in some exciting situations, fighting with a man, if possible, or with another shark. They were determined to secure such a picture, as with these scenes recorded on their films they could be sure that they

had added the vital thrill so necessary for popular appeal. There were some obstacles in the way, however. They would need the necessary bait to draw the monster of the deep near enough to the observation window to ensure a good picture. They were successful in securing the carcase of a horse, and after considerable red tape opposition by the local authorities, they had it towed out to the barge.

The barge and the bait were taken outside Nassau Harbour the next morning, and allowed to drift along the edge of the ocean where sharks are always lurking, big ugly fellows with dark-blue backs and white bellies. The horse had been floating here for scarcely fifteen minutes, when a long, shadowy form was seen gliding, snake-like, past the side of the barge. This shark presently went away, and in half an hour came back with another. Then these two went away, and returned soon afterwards with two more, and so the hungry company grew until a dozen sharks were circling round the carcase of the horse. But they seemed to be shy and suspicious of the strange swaying tube which hung below the vessel, and they would not come up to the horse, swinging there temptingly in range of the motion picture machine.

All that day and the next day the two young men waited patiently and watched, but the sharks kept at a distance, their fears stronger than their hunger. On the third day, however, at about eleven in the morning, one of the ravenous crew darted forward and closed his jaws on the horse's flank.

Then the other sharks drew nearer, and for two hours there was a score of them within striking distance. The time had come for the sensational picture.

Meantime, half crouching on the deck of the barge stood a native, his black, oil-smeared body glistening in the sun, his white teeth shut on a wicked-looking knife. At a word he was ready to dive into the sea and take his chances with one of the brutes below, trusting to his quickness and skill to save him. This man was the best diver in Nassau; it was said that he had once gone down to a depth of eighty feet, and he boasted that he was not afraid of any shark that inhabits the deep.

With fascinated interest, the Americans watched the native while he watched the sharks. The native's task was to time his spring so cunningly that he would shoot down into the sea just in time to meet one of those big fellows in its hungry rush, at a point within range of the moving picture machine, the angle of which is only twenty degrees, and within this angle he must have his death struggle with the beast and kill it. This was the native's commission, a very tempting piece of work for any man.

They waited. A shark circled closer to the bait, then swerved away sharply, and then—suddenly the native lifted his hands and leaped head first into the transparent waters, straight out for the murderous fellow who was making direct for the carcase of the

horse. Those on the deck of the vessel gathered anxiously near the top of the tube to hear the verdict from the observer in the observation chamber. Ernest Williamson awaited signals from his brother in the tube, while George leaned forward and waited for the battle scene to start in front of the observation window. The camera man, in the meanwhile, was all in readiness, waiting with anxious breath for the critical moment. "Start!" called Ernest Williamson down the tube, and the motion picture man immediately began turning for the big and eventful scene.

There was a quick movement of arms and legs as the man and the shark clashed. The man was underneath. The shark struck violently with his tail, half turning, then straightened, stiffened, and slowly sank to the bottom of the ocean. The knife had found his heart. A moment later the native rose to the surface, with victory written all over his ugly countenance. But while it was a personal victory for the native over the shark, it was defeat as far as the moving picture camera was concerned, for all this had taken place out of the range of the motion picture camera. This meant that it all had to be done over again.

Here was the crisis in the expedition.

This shark's picture must be taken. But how? That is the question which puzzled the Williamsons, for they knew that while the wonderful pictures of sea forests and ocean meadows would be certain to interest, yet to give the needed thrill they must

have this battle between a man and a shark. It must be real, and there must not be any fake about it.

Whatever was to be done must be done quickly, for the natives explained that now that one of their number had been killed, the entire school of sharks might suddenly leave as quickly as they had appeared, and once they deserted the carcase of the horse it would take days of coaxing and patient waiting to get them to come within range of the camera again. Moreover, they might be so scared at the mysterious-looking apparatus which had entered their haunts and killed one of their family, that they would never approach it again for months.

But Ernest Williamson was obdurate. They could not miss this splendid opportunity, and the only way to get the thing done properly for the camera was to do it themselves.

"What! kill a shark?" inquired the others.

"Exactly. It is not a difficult trick. I have been watching that native, and I believe I can go down and do it precisely the way he did, and within the range of the camera, too! Come on. We'll try it." And Ernest Williamson prepared to make his descent into the waters of Nassau Harbour.

He stripped off his clothes, while the crew smeared his body with porpoise oil, native fashion, and, taking the keen-edged knife between his teeth, he leaped overboard into the sea. He made for a big shark, which had seen him and was making for him with mouth wide open, showing his six

sets of vicious-looking teeth. At that moment he was right within the range of the camera, but he missed his stroke and came back to the barge. He dived again, and finally obtained what he wanted. He urged the big fellow right up to within a few feet of the glass window of the observation chamber, and drove his knife into the belly of the shark, as Gregory, thrilling as he looked, ground out his film.

Those who watch this exciting battle in the submarine picture may well know that here was an example of daring which has never been approached in the history of film production.

"I wasn't so much afraid of the shark as I was of a miserable fish about a yard long and shaped like a pike, that they call a barracuda. Before I made my dive," said Williamson, "I made certain there were none of those devils present, and I scouted around underneath the barge to see if I could see any of them. When they are hungry their bodies are covered with stripes. The natives call them hunger stripes. Their lips curl back like a snarling dog's, over big strong teeth."

This thrilling incident brings to a close the wonderful story of how the sea has given up its secrets, and has at last bowed to the restless genius of man.

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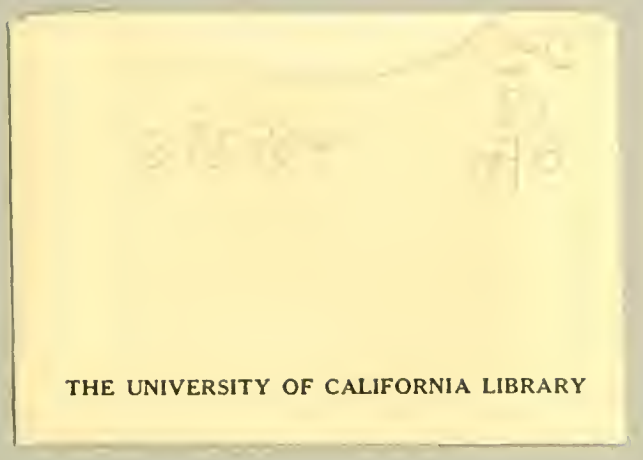
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